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Orderly Maintenance In a Diversified Manufacturing Plant

By Frank I. Wheeler, Jr.
Plant Engineer

MAINTENANCE is a problem common to all manufacturing plants regardless of the nature of the product. But of all types of factories, it is most difficult to establish an orderly maintenance system in one where a wide variety of articles is made in small quantities and where many of the machines are used by several workmen during each day. It was in such a plant that the maintenance system about to be described was established seven years ago. It took two years to complete the work and improvements have been made since then from time to time. A large part of the plant is devoted to the manufacture of a large variety of articles that require sheet-metal operations such as rolling, stamping, spinning, polishing, and the like. Wood cabinetwork, fancy leather work, paper-box making, printing and engraving are also performed. There are about 550 machines ranging from heavy presses, rolls and drop hammers to light automatic machinery. There are also a number of furnaces of various types and 150 or more direct-current motors. The factory generates its own power. The equipment is scattered throughout 31 rooms. About 700 persons of both sexes are employed.

The maintenance department is under the supervision of the engineering department and is responsible for maintenance of the following: buildings, piping, machinery and transmission, machine shop, electrical equipment, power and heating plant, ventilation system, and compressed air system. Beside the maintenance work this department is responsible for the operation of the machine shop, and the power and heating plant. Fire protection, salvage and disposal of scrap and discarded machinery, and plant cleanliness also receive supervision. The maintenance department is headed by the plant engineer and its personnel comprises a plumber, a carpenter, a painter and his helper, four machinists and millwrights, an electrician, a beltman and oiler, two steam engineers, three boiler firemen, and two yardmen. Additional men are borrowed from other departments when occasion requires, for example, on overtime work. There are four less men in this group than at the time the department was reorganized, and much better results are being achieved with the smaller number of men. The time devoted to maintenance work by the plant engineer and his assistant has been increased, however, and the tool-crib boy has to devote about fifty per cent of his time to this phase of his work.

> The maintenance department exerts itself so that fretting of manufacturing department foremen and workmen is reduced to a minimum. Work is completed promptly. Suggestions for improvements are encouraged and are acted upon visibly. When a maintenance order has been issued, the manufacturing foreman is kept advised of the progress of the work and its probable completion date

The maintenance department exerts itself in general so that fretting of manufacturing department foremen and workmen is reduced to a minimum. Work is delivered promptly through planned schedules. Suggestions for improvement are encouraged and acted upon visibly. When a maintenance order is issued at the request of a manufacturing department and is of reasonable im-

The first of three articles. The second will appear in an early issue.

portance, the manufacturing foreman is kept advised of the progress of the work and its probable completion date. When work is done during overtime, all resulting dirt and refuse must be cleaned up and scattered equipment must be replaced before the men leave. The foreman of a manufacturing department is advised beforehand if changes in his room layout or repair of equipment are contemplated, and his agreement is secured. Work done during overtime is inspected promptly at the beginning of the next working day to see that it is giving satisfaction. When an alteration or an attachment that is of more than incidental importance is contemplated in either plant or equipment, an estimate of the expense involved must be made and approved before work is started.

All work that requires operations of any magnitude is planned and carried out according to schedule. The several maintenance divisions concerned are co-ordinated, the men needed are located, the necessary tools are put in condition, and the required material is checked, and if purchased outside, proper delivery is obtained. The removal of men from half-completed jobs and their placement on other work is discouraged.

At the time the new maintenance department was installed, a good background was furnished for its successful operation by placing the plant and its equipment in first-class condition. The improvements included the following: new layout of the machine shop and the purchase of several new machine tools; installation of a tool crib in the machine shop in place of stock shelves along the wall; re-conditioning of all machines, fifty per cent of which were completely overhauled; improvements in the power drives, including the replacement of about forty countershafts with about the same number of motors (resulting in a saving of about 50 kw.); removal of old open electric wiring and its deteriorated supporting board and the installation of modern lighting layouts in each room; provision for electric current in place of gas for use outside of working hours, when engines were not running; removal of useless pulleys and stringers; removal of piping and relocation of other pipe lines, and the marking of all pipes with color bands placed where the pipe enters and leaves a room and at branch connections; and the painting of each room with standard colors. Contact with the several maintenance divisions was improved by installing an electric call-bell system.

Indexed Records of Changes

Drawings were made for each room showing the equipment layout. Piping and wiring systems were also charted and placed with other tracings and sketches of value in a cabinet so indexed that they could be readily located by means of a card system. All changes in room layout are kept up to date on these drawings.

All subsequent sketches or drawings for altering equipment, building new equipment and locating it in department layouts, and for relocating old equipment are also filed for future reference. Sketches showing the work to be done usually accompany the maintenance order. Field measurements and calculations of all developments or repairs of any size are preserved in loose-leaf folders, one for each department and for several general groups. Power charts showing kw.-hr. usage, coal, gas, electricity (outside) and water consumption are also filed by the maintenance department.

A catalog file is also kept. It is divided into groups or types of equipment and material so that the maintenance department is in touch with the latest types and sources of supply. The cross-sectional views and the descriptions of equipment in the catalogs are also useful in replacing a damaged part. When equipment is purchased, a carbon copy of the order and a blueprint (if there is one) is retained by the maintenance department.

The chief element of routine control is a tickler system. The tickler notifies when inspections are due, follows progress of repairs, follows up delivery on maintenance purchases, watches new equipment for proper performance, and even has been used as a reminder

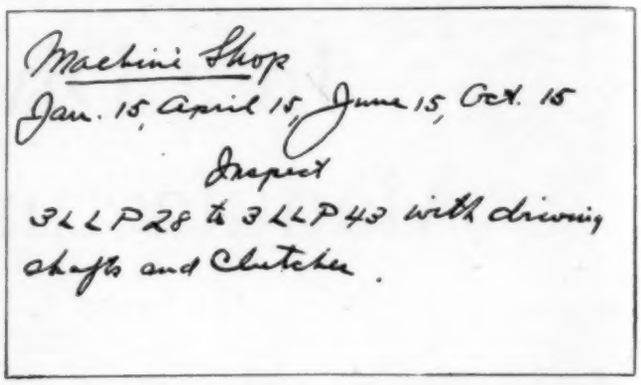

Fig. 1—Example of tickler ticket

for such things as the days when the flag should be flown, the shut down of power for a short interval on Armistice Day, and the adjustment of clocks twice a year for daylight-saving time, and similar functions.

The tickler has twelve cards with tabs corresponding to the months of the year and sufficient cards with numbered tabs to fill in daily dates for three months. The tickler cards proper are filed in between these daily division cards. They are of note-paper thickness and are 3x5 in. in size. On the top of the card are listed the dates they are active surmounted by the name of the department or executive responsible. The duties required are listed in the body of the ticket, which is shown in Fig. 1. Another tickler system almost duplicates the first. Except for those tickets directing the plant engineer or his assistant, purchase follow ups, or special inspections, a duplicate card of the same size and carrying the same instructions as the original card is made of press board (0.017 in. thick) and placed in the second tickler. These tickets are designed for rough handling and are issued to the responsible maintenance foremen when due, serving as his order for the work outlined. Lines are ruled on the back of the ticket for the foreman's O.K. or his recommendation with the date. Several years' comments can be placed on the back of one ticket. As recommendations are acted upon, they are checked off. No verbal reports are accepted.

Each day the assistant plant engineer removes from the tickler the tickets for that date, delivers the press-board tickets to the maintenance foremen and places on his desk or the plant engineer's desk the note-paper tickets that have no press-board duplicates. These note-paper tickets must be returned the same day after the work to be done has been noted. The note-paper tickets that have press-board duplicates are placed in a special compartment of the tickler where they remain

until the corresponding press-board ticket is returned with the inspection report on its back. Then both tickets are filed in their respective ticklers under the next date that they will become active. As the daily tab of the current month becomes due it is placed in position again as a daily tab for the third month after the current month.

The press-board tickets are tan in color for the machine shop and other maintenance departments, except belting. The belt tickets are gray except for new belts, in which case they are white for the frequent inspections until the belt reaches the age when inspections are made at 6-month periods.

In addition to the two ticklers there is a file for tickler cards grouped under tabs named for the responsible maintenance executives and foremen. These are duplicate note-paper cards of the same size as the originals. This file does not include machine inspection tickets, all of which are designated on a chart for reference purposes, nor belt inspection tickets, which are checked from the belting cards. Hence this file has little bulk. Its purpose is to facilitate reference to certain cards as well as to show in a group the several duties of each executive.

The tickler system is checked yearly for discrepancies and accumulation of useless routine, and it in turn provides for a yearly or bi-yearly check of all the important maintenance functions of the plant engineer.

Orders for Larger Jobs

Minor repairs are handled without orders and are reported direct to the maintenance foreman by the manufacturing foremen. Major repairs or layouts requiring more than one hour of labor are not initiated without the issuance of an order except in an emergency, in which case the order follows the starting of the work. A manufacturing department asks for a major repair or an alteration on a regular requisition form, and upon the receipt of this request the maintenance department investigates the work. Unless some features are objectionable a maintenance order is then issued.

All maintenance order numbers have the prefix "M" to distinguish them from other orders and requisitions. They are written in note books, 6½x4-in., having alternate white and yellow sheets; the white sheets are perforated and the yellow sheets serve for a carbon copy. The sheets are blank except for the order number in the upper right-hand corner, the pages being numbered consecutively in pairs. The carbon copy stays in the book for record and on it are placed the hours of labor put on the order each day with a coded letter for each workman. This information is obtained each morning from the daily time slips. Orders are generally issued and distributed in the late afternoon. Each maintenance department has its own active order book from which orders for its own department alone are issued.

Upon completion of the work on an order the white sheet is returned to the maintenance department with the date of completion marked on its face and a description of the work done, unless already covered by the order wording. This date is entered upon the carbon copy. When most of the orders in a book (contains 50) are completed, the few remaining orders are listed on a slip that is fastened to the book. Besides facilitating inquiry, this list serves as an additional incentive to follow up and complete the orders. Very old orders that are still extant are recorded on a card for each foreman that is filed with the active order books. The old books are all stored for possible reference, and the books of the past year are kept within easy access, filed under the name of the department.

Twice a week an active follow up is made to see that no orders stagnate, since it is expected that all work of ordinary urgency should be completed within a week. Old orders are checked twice a year to eliminate them or to hasten their completion.

Each man in the maintenance department makes out a daily time slip on which his time is distributed. These time slips are turned over to the maintenance department early the following day and after the labor charged to various orders has been noted and other information transferred to card records, the slips are sent to the accounting department. Once a week the accounting department sends the maintenance department a weekly time card made up from the daily slips for each man. These cards are studied for amount of overtime, tardiness, and the scope of the work. In a column provided, the proper charge account for each item is indicated by code, and the cards are then returned to the accounting department.

Each maintenance foreman has a book of requisition blanks for obtaining material. These requisitions are initialed by the executive in charge of maintenance before they are sent to the purchasing department. Material drawn from stock, apart from tool-crib stock, is charged on the back of the maintenance order. Purchases made solely for a particular maintenance order are charged directly to the department for which the work is being done. Each manufacturing or maintenance department has an individual account, audited monthly, in which these charges are entered.

When machinery, motors, or other equipment are moved from one department to another or discarded, or new equipment is installed, the accounting department is notified on forms provided for that purpose that

ENGINEERING DEPT. EQUIPMENT REPORT

DATE Sept 2 1926 MACHINE NO. Was 8 P6 now 8 V.P. 2

DESCRIPTION Open back single acting press

MAKE Blake & Johnson

COST _____ INSTALL. _____ FREIGHT _____

REMARKS 8 P6 converted to a power shear. Appraisal value installed raised from $75.00 to $300.00 by improvement—was idle before.

R. H.

Fig. 2—Form used to acquaint accounting department with changes in equipment

show departments to be credited or debited, cost of installation, purchase price, cost of additions to equipment, and the junk value, if discarded equipment. A typical form is shown in Fig. 2. The dispatch of this notice is checked by an entry on the equipment card.

The time required for all clerical work in the maintenance department is about one and a half hours per day on the part of the assistant plant engineer. A considerable part of the work done by the department

is in the nature of improvements as well as upkeep of present facilities. The maintenance department regularly receives accident reports on the possibility that safeguards that would prevent a recurrence can be devised and installed.

The maintenance of buildings and grounds is provided for by systematic inspections by the plant engineer, the carpenter, the painter, or the plumber as directed by the tickler. For instance, every spring each roof is inspected for broken slates and for gutter and skylight repairs; outside woodwork, ironwork, piping, cowls, etc., are inspected for need of painting, and the roadway for holes to be filled. Twice a year window sashes are inspected for tightness, windows for broken panes and loose putty, and courtyards for cleanliness. Other routine inspections include that of building walls for brickwork pointing and roof ladders for safety.

Inside, the rooms are inspected quarterly for general cleanliness and proper location of movable equipment. Halls and stairways receive a special cleaning twice a year. Windows are cleaned at regular intervals. Rooms are repainted at sufficient intervals to keep them in good appearance. When changes in location of equipment are made the bare spots are promptly painted to conform with surrounding areas.

Sanitary equipment is examined regularly, as are window shades for need of replacement, and doors for condition and hardware. Piping trenches and subways are examined monthly and are cleaned yearly. The main control valves are inspected and tested twice a year, and small valves more often. The tickler even reminds the maintenance department about the installation and removal of screens and the clipping of ivy from the windows in summer.

Tolerances and Fits—Discussion

BY L. BUZZARD
London, England

IN AN article by John R. Godfrey, under the title given above, and published on page 705, Vol. 65 of the *American Machinist*, the author made some very pertinent remarks on the subject. They were particularly interesting, since they dealt with the way in which the man in the shop views the tolerance problem. There are one or two points, however, which I would like to touch upon.

In the first place, it is fairly well accepted that the method of unilateral tolerance is the cheapest to apply. The bilateral method produced a number of limit gages of peculiar sizes which often became the joke of the shops.

It was stated by Mr. Godfrey that it was desired of the men in the shops to aim for the mid figure, where a maximum and a minimum were specified in the tolerance. Tolerance has been described as "A difference in the dimensions of a piece prescribed in order to tolerate unavoidable imperfections of workmanship." Now while this statement is correct as far as it goes, it does not well express the true use of tolerance in production work. It seems to me that confusion is made between the method of working in the toolroom and in the manufacturing shops. If a job is sent to the toolroom, the best way is to set a nominal dimension with plus and minus tolerances. Generally speaking, you may be pretty certain that the toolmaker will not be far from the nominal, and so you get the best possible job. In this case an aim is made to the middle of the extreme dimensions.

In the production shops the thing is different. For various reasons, work will vary slightly even if the machines are of good quality and new. This variation for, say, half a dozen consecutive parts will be very slight indeed. In small work on automatics, one would need to use the vernier of one's micrometer. A certain amount of the tolerance given to the job is to accommodate the error just mentioned. By far the greater part, however, goes to allow for tool wear. The greater the tolerance the greater will be the number of parts produced before resetting is necessary—this is assuming that setting is made in the proper way. Clearly it is wrong for the setter to aim at the middle figure, since by doing so he is limiting the useful life of his tool layout. Suppose that the job is plain turning a piece of rod to the limits 0.324 max. 0.320 min., and that it is one of the operations on an automatic. The variations in consecutive parts would not exceed 0.0005 in. if the machine was at all good. Suppose then that the setter aimed at the mean, 0.322 in. he would have 0.00175 in. for tool wear. On the other hand, if he aimed at the minimum size but made due allowance for the consecutive variation, he would have 0.0035 in. for tool wear—just twice the previous figure. Theoretically this would mean that by aiming near the minimum, the setting costs would be reduced by half. Actually, this is not quite correct because the tools might refuse to cut before wear had gone to the amount allowed. Nevertheless, the principle is all right and I think is the one adopted by most setters.

MUST KNOW THE MACHINE

As to just what figure is to be aimed at in the setting of a machine, can only be decided by the man who knows the machine thoroughout. I mean that he knows the little characteristics of the machine individually, and not just as, say, a No. 00, B. & S. The target figure depends also upon the method to be adopted in the tooling. With a box tool, clearly it would be nearer the minimum than where side turning was to be employed.

Actually most makers of small tools such as reamers and taps, cater for tool wear by making their product a definite amount oversize. The amount allowed in this manner must clearly be within the tolerance of the job.

I am of the opinion that the best way in which to specify tolerance on a plain turned part as 0.320 in. —0, +0.004 in. This method gives the setter the figure below which he must not go, and at the same time shows him how long he can let the machine run without resetting. Holes would be treated in a similar manner, but of course it would there be how much undersize they would be allowed to drop.

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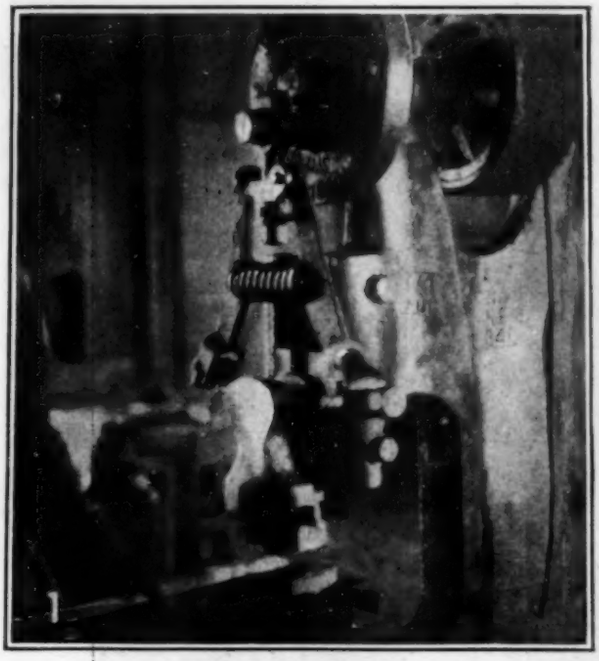


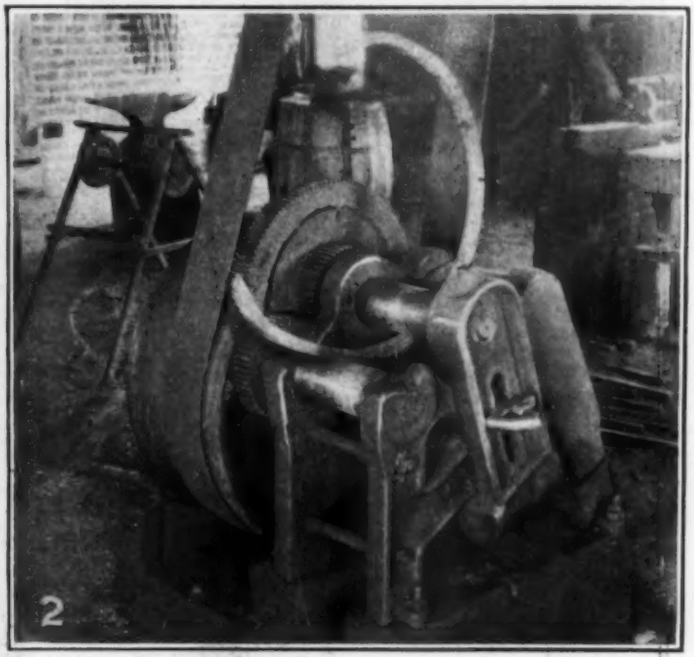


Fig. 1—Scarfing the end of the strip in a cushion hammer.. Fig. 2—Rolling strip to shape

Production of Starter Gears in a Small Shop

By Frank W. Curtis
Western Editor, American Machinist

PRODUCTION methods as applied to the manufacture of starter gears by the Colorado Gear Manufacturing Co., Denver, Colo., are typical of what can be done in a small shop when the parts are made on a quantity basis. Work is run through the shop in amounts sufficient to reduce set-up costs and in accordance to market requirements. Between 7,000 to 10,000 starter gears are carried in stock so that immediate deliveries can be made. Considerable attention has been directed toward the sequence of operations and those used satisfactorily produce the output economically. In many cases the nature of the operation permits one operator to run two or three machines, thereby lowering the machining costs. The work is machined in group set-ups when possible as will be seen in the illustrations that show the operations performed from the raw material to the finished product.

First operation. Fig. 1—The material, S.A.E. 1020 steel, is sheared to the lengths required for rings of various diameters. One end is heated to 1,450 deg. F., and scarfed in a 50-lb. cushion hammer, after which that end is curved slightly by hand to assist the rolling operation that follows. The operation is repeated on the other end, forming the scarf in an opposite direction.

Second operation. Fig. 2—The strip is passed through a rolling machine to form the ring. From one to four rings are rolled at one time, two passes being required to complete the shape. The machine is of special design, having three rolls, two of which are smooth faced and stationary, and the third being corrugated and adjustable. The work is shown partially through the rolling operation. The corrugated roll is driven by gearing as shown.

Third operation. Fig. 3—The ends of the ring are heated in a forge and welded together in the hammer previously illustrated. The weld is dressed by hand on

Automotive Production

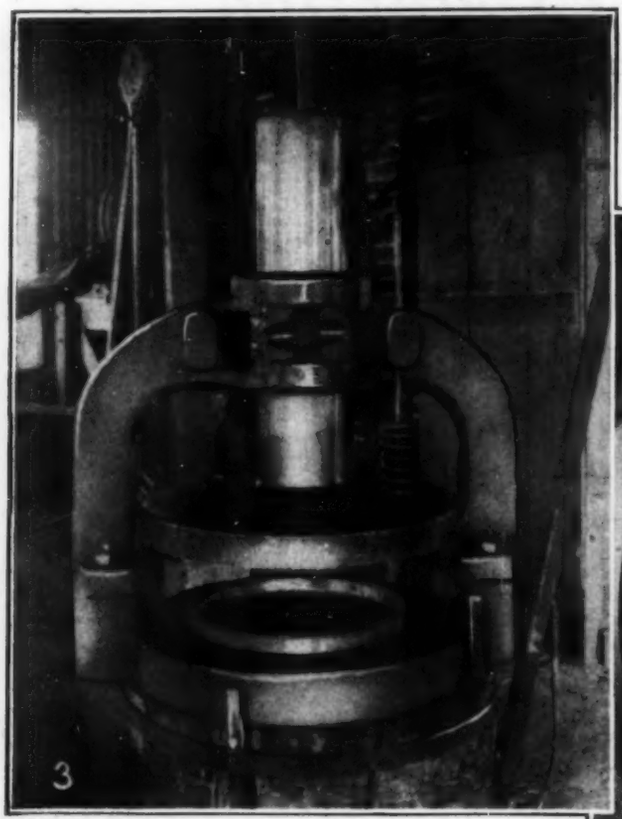


Fig. 3—Strightening the ring prior to machining

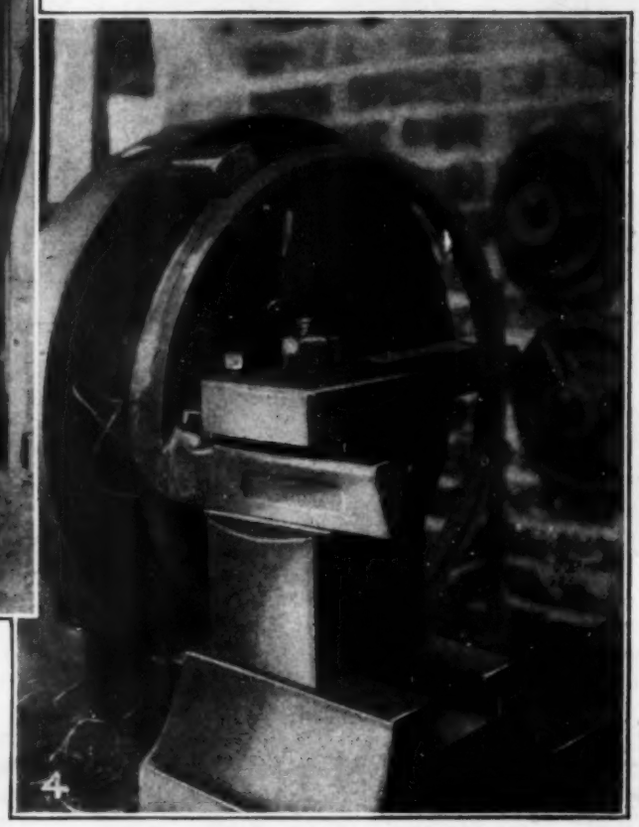


Fig. 4—Facing both sides of the ring

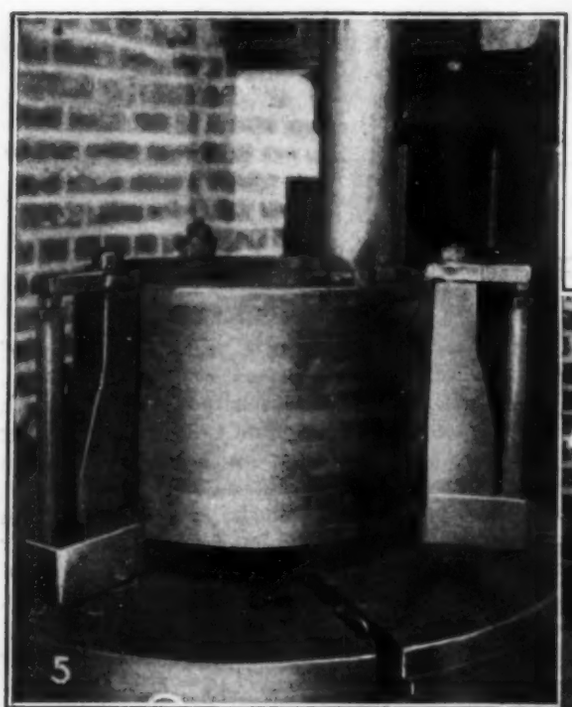
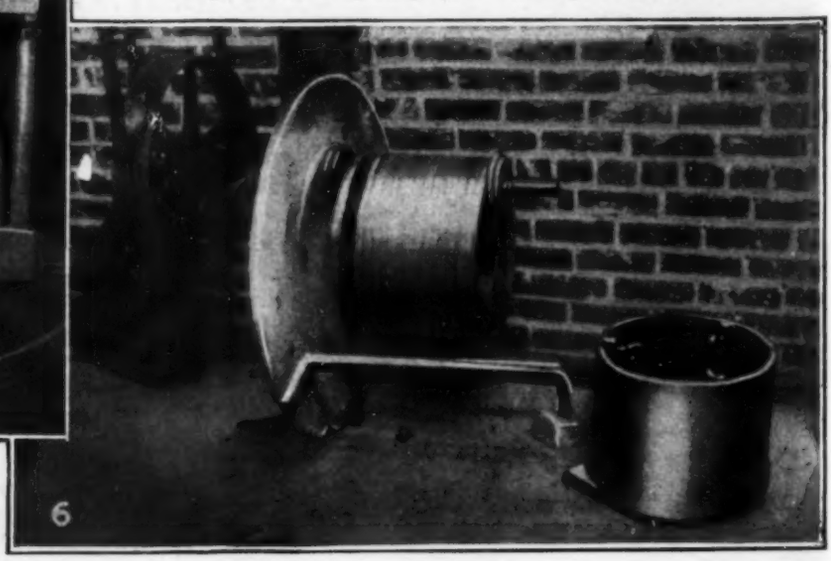


Fig. 5—Rings set up for boring

Fig. 6—Heating rings for shrinkage on mandrel



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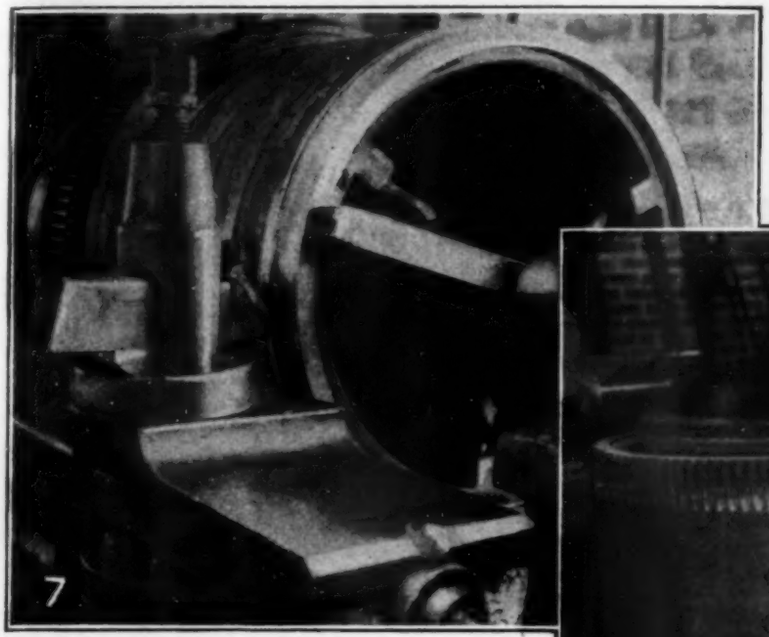

Fig. 7—Rough and finish turning a set of rings

Fig. 8—Cutting teeth in a gear hobber

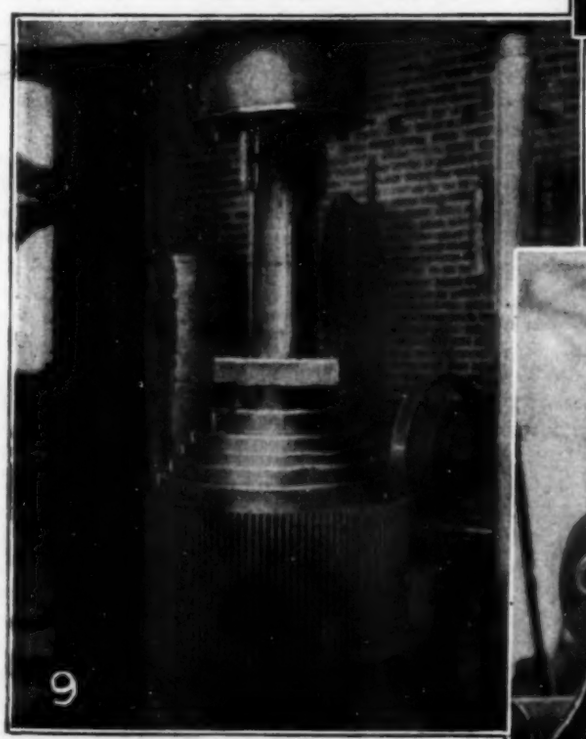

Fig. 9—Removing mandrel by hydraulic pressure

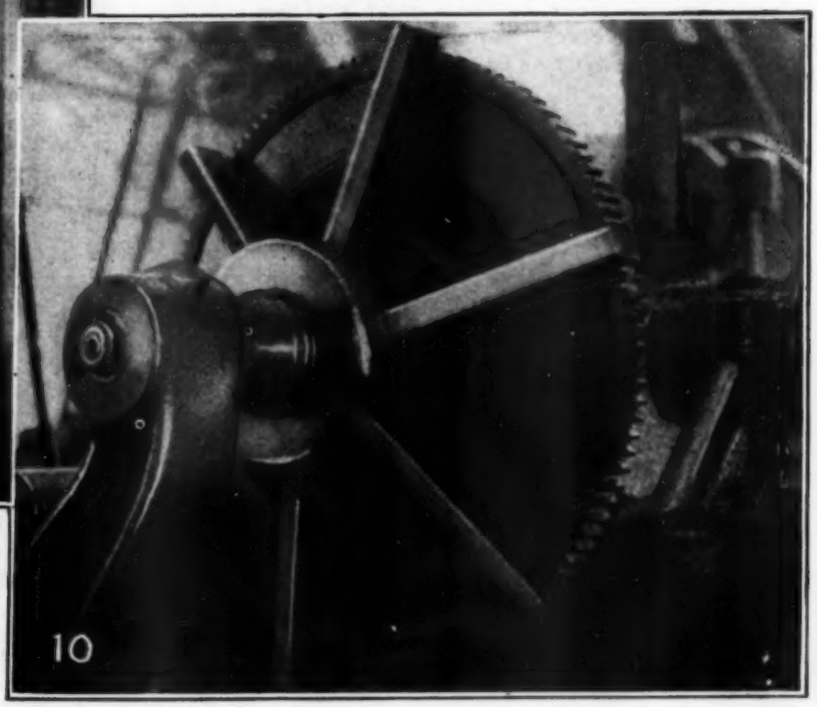

Fig. 10—Beveling gear teeth individually

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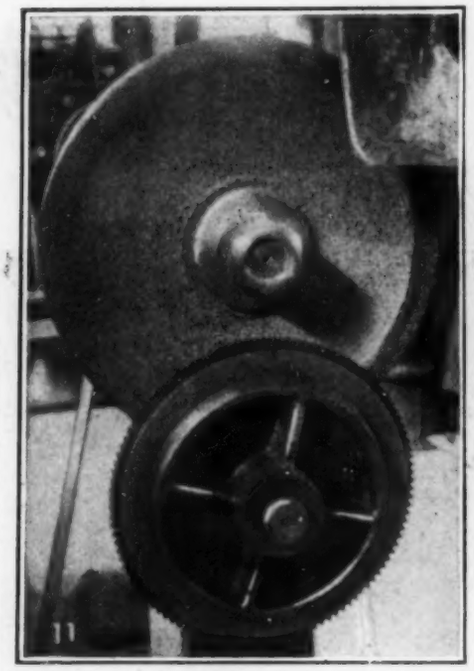


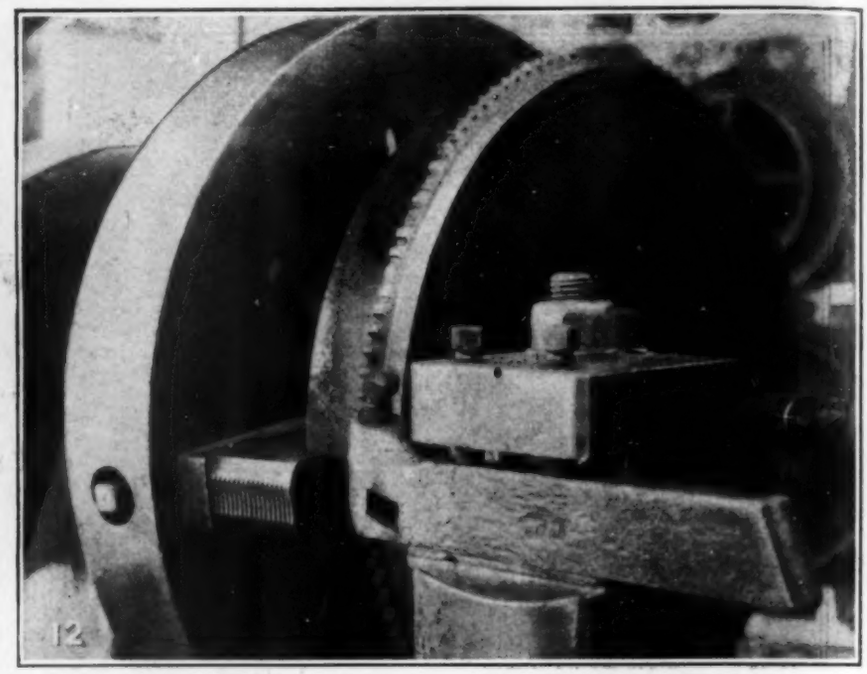


Fig. 11—Grinding the faces of the ring. Fig. 12—Preparing a flywheel for a starter gear

an anvil, then the ring is reheated to 1,450 deg. F. and flattened in the straightening block illustrated.

Fourth operation. Fig. 4—The first machining operation is the facing of both sides of the ring. The work is held in a three-jaw chuck and faced on one side, after which it is reversed for the facing of the opposite side. The thickness is held to a tolerance of ±0.005 in. The machine is operated at 40 r.p.m., and approximately $\frac{1}{32}$-in. of metal per side is removed.

Fifth operation. Fig. 5—Between 8 and 16 rings are mounted in a boring mill and bored to a tolerance of ±0.002 in. The work is held by three clamps that centralize the rings by their outer surfaces. A pin gage is used to check the finished size of the bore. The machine is operated at 20 r.p.m. and 0.032 in. feed per revolution.

Sixth operation. Fig. 6—The rings are heated to approximately 400 deg. F. and placed on a cast-iron mandrel. While being heated the rings rest on and are revolved by a driven shaft under which is located a gas flame. A set of rings remains on the shaft 10 min. After the rings have been placed on the mandrel, the unit is dipped in water, causing the rings to shrink in place. Between 0.002 to 0.003 in. on the diameter is allowed for shrinkage.

The rings are retained on the mandrel for all succeeding machine operations and not removed until after the teeth are cut, thereby insuring the outside diameter, the pitch diameter and the root diameter to be concentric with the bore.

Seventh operation. Fig. 7—The outside diameter is rough and finish turned to limits of ±0.005 in. A 6-in. plug, attached to the spindle of the lathe, centers the mandrel from a similar sized hole in its bottom end. Three bolts, tightened by a socket wrench from the open end, hold the mandrel in place. The open end is supported by a bar and the tailstock center as illustrated. The roughing cut removes $\frac{1}{16}$ to $\frac{1}{8}$ in., and the finishing cut removes $\frac{1}{32}$ in. of metal. The speed of the machine is 60 r.p.m. for the operation.

Eighth operation. Fig. 8—The set of rings is transported to the hobbing machine where the teeth are cut as shown. Only one cut is taken. The mandrel is centralized by a plug mounted on the machine table, and is clamped by a plate that is tightened against the open end of the mandrel by stud, a C-washer and a nut. A soluble-oil cutting compound is used.

Ninth operation. Fig. 9—The work is removed from the mandrel by a 40-ton hydraulic press. The edge of the work is supported on a drum so that the mandrel will have clearance to pass downward as the run descends.

Tenth operation. Fig. 10—One side of the teeth is beveled in a gear-tooth beveler as illustrated. The work, handled individually, is located over a ring plate by its inside diameter and held in place by a spider. To release the work, a nut on the central shaft is run back a distance sufficient to permit the work to slide off the locating plate. The machine bevels 60 teeth per minute.

Eleventh operation. Fig. 11—Disk grinding of both sides of the gear is the final machining operation. The work is placed on a cast-iron center that has a hole in it to fit a stub shaft located on the machine base. The work, fed to the abrasive wheel and revolved by hand, has its burrs and tool marks removed. In this condition the gear is completed and ready for use.

In applying the starter gears to flywheels, it is necessary to remove the cast teeth as shown in Fig. 12. A shrinkage allowance of 0.0015 in. per inch of bore diameter is provided in the making of the ring, and the ring is stamped to the correct size to which to turn the flywheel. Thus in mounting, the operator is not required to figure sizes but merely turns the flywheel to the diameter specified. The ring is expanded by heating, placed on the flywheel, and allowed to cool until it is securely shrunk in place.

Photograph by courtesy of Ward Harrison

An example of a high standard of artificial lighting

Profit from Good Lighting

By M. LUCKIESH and FRANK MOSS

Lighting Research Laboratory, National Lamp Works of General Electric Co.

Artificial lighting is below the standards that are required—Production increases as illumination intensity rises—The cost of improved equipment

ARTIFICIAL lighting has been generally accepted as a necessity in modern industries. It has been called upon to create a dependable and uniform lighting during the day as well as at night. The development and use of artificial lighting has been brought about largely by meeting the constantly increasing demands of industry for lighting. However, the usual lighting practice has been to supply the minimum rather than the desirable intensity of illumination. Two factors have contributed toward this attitude. Outdoors, man has been abundantly supplied with high intensities of light without cost, but when he was obliged to purchase light to aid him in carrying on his activities indoors, it was natural to regard it as a profitless overhead. Moreover, early illuminants were of such an unsatisfactory and inefficient character that it was often with some difficulty that the minimum lighting requirements were supplied.

The comparatively recent development of controllable illuminants and effective lighting equipment has made indifference to artificial lighting unprofitable. Some executives have already realized this and have looked upon expenditures for the lighting of their factories and offices as good investments. As such, lighting has paid large dividends in proportion to the amount of capital invested and to the care with which the investment was made. Those industries that have failed to take full advantage of the possibilities of good lighting not only have lost the profit accruing from a good investment, but also they are paying dearly for the obsolete lighting systems maintained. Inadequate or improper lighting has as little justification in modern industry as has obsolete and inefficient machinery.

The problem of determining the best lighting for an industry is not one of seeking that which costs the least but rather that which will produce the largest return per dollar invested. It should be realized that the lighting design and illumination intensity used in the lighting of an actual factory will be quite different from that which would be desirable if the cost could be neglected. However, a consideration of the characteristics of the most effective illumination from a theoretical viewpoint is helpful in the weighting of the factors of cost and desirableness in the actual installation.

In order to simplify the analysis of the most effective lighting it will be assumed that the intensities of illumination chosen are used to their greatest advantage. Hence the problem is reduced to that of determining the ideal intensity of illumination for the various types of visual work. Daylight outdoors com-

monly reaches 5,000 foot-candles. The average intensity of illumination in indoor artificial lighting is about 5 foot-candles. These values should be realized when considering the factor of intensity of illumination.

Many laboratory experiments have been performed to determine the intensity of illumination at which the maximum in visual work is obtained. While it is not possible to describe them in detail, the results of the experimental work can be summarized in a general way.

For reading black print on a white background where it is not necessary to see in shadows, 350 foot-candles is advisable.

For discriminating very dark details on backgrounds that reflect 20 per cent of the incident light, 1,400 foot-candles is best.

For general work, assuming an average background reflecting 40 per cent of the light and where seeing in shadows not required, 700 foot-candles is sufficient.

For general work, as in the previous case but where seeing in shadows is important, at least 1,000 foot-candles is required.

The maximum upper limit of the desirable intensities is not far from 3,000 foot-candles.

Since these intensities of ilumination were obtained under laboratory conditions it is certain that work conditions would not demand lower intensities. These values represent the most effective intensities of illumination for visual work. If these intensities of illumination seem extreme, it is because long association with practically the minimum in artificial lighting has prevented a true perspective of good visual conditions.

When the factor of cost enters the calculations, the lighting must be designed to produce the most economic intensity of illumination due to the operation of the law of diminishing returns. Fortunately, the range of illumination intensities where the greatest improvement in visual conditions occurs, lies within the reach of modern illuminants. Hence the utilization of "high-intensity" illumination as a means of producing better and more work from the same equipment is possible.

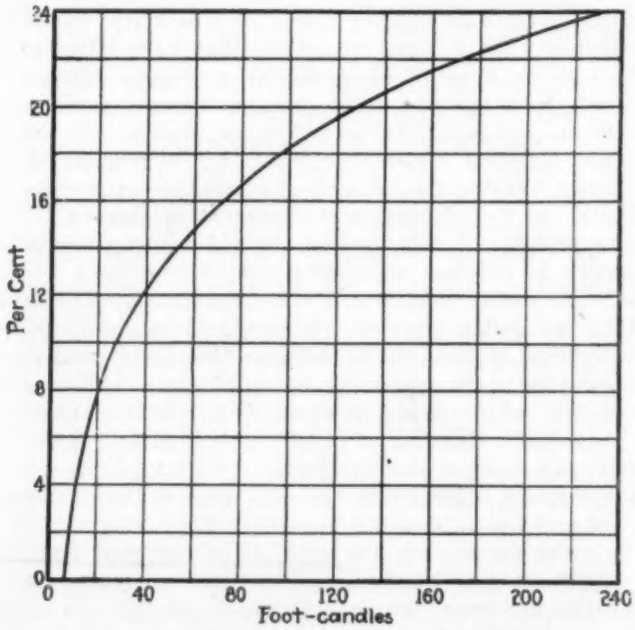


Fig. 1—The increase in production resulting from increased illumination

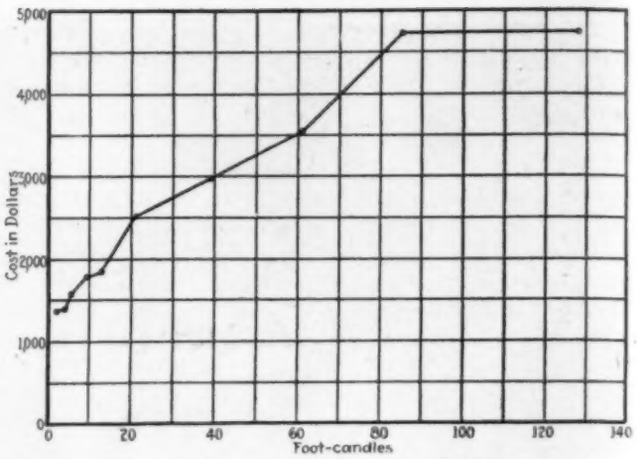


Fig. 2—The cost of installation of a lighting system

The most economic intensity of illumination can be determined by estimating the value of the increase in production. In making this estimate there are three essential factors to be analyzed:

(a) The monetary value of the increased production expected from better lighting.

(b) The cost of the lighting installation necessary to obtain this increase.

(c) The cost of operating the lighting system.

In Fig. 1 is indicated the increase in production in terms of per cent of the payroll, that may be reasonably expected in work where vision plays an important part, as in inspection work. The curve from 6 to 20 foot-candles is obtained directly from factory data. Beyond 20 foot-candles the curve is extended according to a formula obtained in the laboratory which, in general, governs the performance of visual work. The increase in production resulting from the use of higher intensities of illumination will obviously have a value directly proportional to the wages paid the workers. Furthermore, not only is a most worth-while increase in production to be had, but also this gain is obtained without increasing the overhead except by the lighting cost.

The cost of installing a lighting system for a factory, say 100x200 ft. in size, is illustrated in Fig. 2. The lighting for each range plotted is designed according to the best modern wiring and equipment practice. It will be noted that the cost is by no means proportional to the level of intensity of illumination, thus making the use of the lower values of illumination relatively more expensive.

The operating cost of the lighting system is a variable of considerable importance in selecting the intensity of illumination to yield the greatest profit. The cost of electrical energy is predominant in the total operating cost and owing to its variable rate, the data are presented in Fig. 3 for three different rates. It is interesting to note that at intensities of illumination above which the increase in the cost of the lighting is of no practical importance, the rate of increase in production as shown in Fig. 1, gives no indication of reaching a maximum.

From these data an estimate can be made of the profit that good lighting may be expected to produce where conditions are somewhat similar to those used in this discussion. The estimate will be a most conservative one, since the evaluation of good lighting has been based only upon one of its many benefits.

The records of production in each shop or department of an industry provide an accurate means of determining the value of good lighting. In one factory, the lighting was improved by stages and the increase in production for each change in intensity of illumination was carefully determined. All possible precautions were taken to keep extraneous factors constant so that the results could be directly attributed to the effect of the lighting. The results of this investigation are indicated in Fig. 4. The original lighting averaged about 5 foot-candles and was obtained from a mixture of daylight and artificial light. This system of illumination was replaced by new and well-designed installations that produce intensities of illumination of 6, 13 and 20 foot-candles, respectively. It will be noted that there was a steady increase in the production with increasing intensities of illumination which amounted to 12.5 per cent when 20 foot-candles were provided. This 12.5 per cent increase is an important gain, since the cost of the light that made it possible was only 2.4 per cent of the payroll. In other words, a net of 10 per cent increase was obtained without expense.

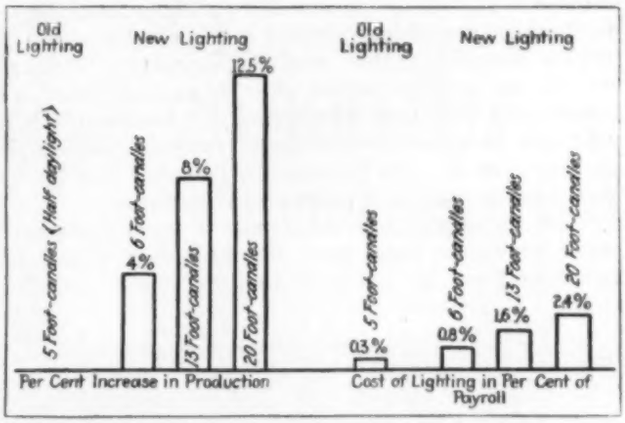


Fig. 4—The per cent of increase in production for various intensities

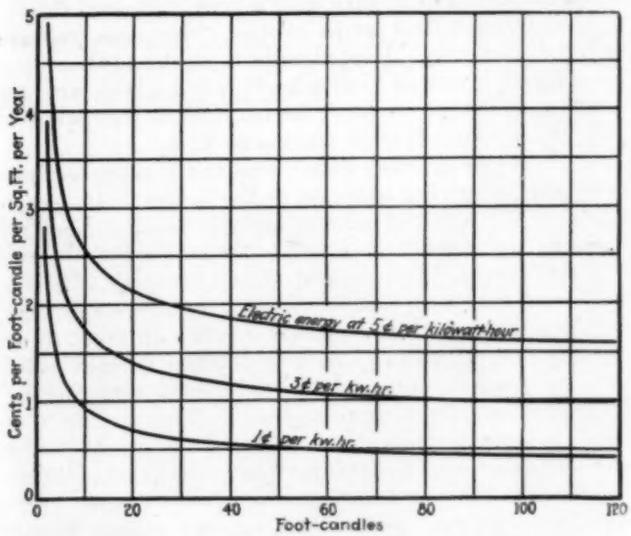


Fig. 3—The operating costs of the lighting reduced to cents per foot-candle per square foot, per year

The increase in output of work with better lighting is possible in most of our work places. The data given in Table I are representative of both the value of good lighting and the diversity of work where increased production is obtained. In nine investigations summarized in the table, an average increase in production of 15 per cent was obtained with an expenditure of only 2 per cent of the payroll for the cost of the lighting.

The most economical intensity of illumination will depend, of course, upon the type of work to be performed under the lighting. Since there can be no doubt as to the desirability of illumination intensities of hundreds of foot-candles, the improvement that is to be made in the lighting should certainly proceed at least to the most economic point. Looking at the same problem from another standpoint, suppose the intensity of illumination of a certain factory is raised from an original value of 6 foot-candles to 20 foot-candles, as shown in Table II. This improvement in lighting will produce an increase in production of 8 per cent which, in turn, will earn enough to pay for a 100 foot-candle system if wages are 45 cents per hour, or for a 200 foot-candle system at 90 cents per hour. Thus the original investment in a 20 candle-power system is

Table I—Tests showing per cent of increase in production*

Operation	Average Foot-Cand. With Old System	Average Foot-Cand. With New System	Increase In Production With New System (Per Cent)	Additional Lighting Cost In Percentage of Payroll
(a) Pulley finishing	0.2	4.8	35.0	5.0
(b) Soft metal bearing manufacturing	4.6	12.7	15.0	1.2
(c) Heavy steel machining	3.0	11.5	10.0	1.2
(d) Carburetor assembling	2.1	12.3	12.0	0.9
(e) Manufacture of electric, gas and sad irons	0.7 (4.0 at tool point)	13.5	12.2	2.5
(f) Semi-automatic buffing of brass shell sockets	3.8	11.4	8.5	1.86
(g) Manufacturing piston rings	1.2	18.0	25.8	2.0
(h) Letter separating	3.6	8.0	4.4	0.6
(i) Inspecting roller bearing parts	5.0	20.0	12.5	2.4
Average	2.69	12.47	15.04	1.96

(a) Pyott Foundry Co. (Tested by Commonwealth Edison Co.)
(b) Foote Brothers Gear & Machine Co. (Tested by Commonwealth Edison Co.)
(c) Lee Loader Body Co. (Tested by Commonwealth Edison Co.)
(d) Stromberg Carburetor Co. (Tested by Commonwealth Edison Co.)
(e) Dover Manufacturing Co. (Tested by the National Lamp Works of the General Electric Co.)
(f) General Electric Co. (Tested by General Electric Co.)
(g) Detroit Piston Ring Co. (Tested by Detroit Edison Co.)
(h) U. S. Post Office Department (Tested by Office of Industrial Hygiene of the United States Public Health Service.)
(i) Timken Roller Bearing Co. (Tested by the National Lamp Works of the General Electric Co.)

* Compiled by Ward Harrison.

capable of paying for an installation many times higher in illumination intensity from which all the benefit of such a desirable system could be expected. While we do not know from actual shop tests just what will happen at 100 foot-candles, the data at hand would indicate that substantial advantages continue beyond the 20 foot-candles. An increase in intensity far beyond this point will prove a profitable experiment.

Good lighting has proved itself a good investment when evaluated only upon the increased production resulting from its use. In addition, there are other

Table II—Foot-candles that can be purchased by increased production

Per Cent of Increase in Production	Actual Foot-Candles	Foot-candles that can be purchased by the increase in production at various hourly wage rates			
		30 Cents	45 Cents	60 Cents	90 Cents
0	6 0				
2	9.4	17	25	33	50
4	13.0	33	50	67	100
6	16.6	50	75	100	150
8	20 0	67	100	133	200

advantages such as improvement in quality of work, reduction of errors, prevention of accidents, and the protection of health and morale among the workers. The importance of these less tangible benefits of good lighting is indicated by the attitude of the manufacturers who were asked to rank the advantages as they saw them. The interviewed manufacturers rated the various advantages known to the lighting expert as follows:

Increase in production.....79 per cent
Decrease in spoilage.....71 " "
Decrease in accidents.....60 " "
Improvement in discipline.....51 " "
Improvement in hygienic conditions.41 " "

In the individual instance any one of the several factors mentioned may assume importance enough to justify the cost of the lighting that produce it. While this discussion has been concerned chiefly with manufacturing, it should be noted that the principles apply also to the office and all other work-places.

The Testing of Welds

IN AN address before the International Acetylene Association, S. W. Miller said that a weld cannot be inspected internally to determine its quality, but it has been amply demonstrated that tests can be devised that will prove the integrity of the welded structure, provided the other links in the chain receive the proper attention. There are many other structures to which the same statement applies. One of the best illustrations is concrete. There is no way of inspecting the interior of concrete and procedure control in its construction is necessary and has been carried to a very high degree of development. The testing of concrete structures is done in practically the same way that welds are tested, by applying a test load of more than the normal working load and it has been found by experience in both concrete and welding work that when the procedure is proper, safe results are always obtained.

Jake's Views on Giving Presents to Bosses and Ex-Bosses

"HAVE you heard the latest news?" asked Jake as he fell into step with his friend Ben on their way out to lunch.

"I haven't heard anything startling lately," Ben replied. "What have you heard that is important enough to agitate your gray matter.

"R. E. is through. He thinks that he has worked long enough, he is seventy, and he is going to take it easy for the rest of his life. The company have known it for some time but the news just got out into the shop. R. E. didn't want anything said about it until he was gone but it leaked out somehow, and the boys in the upper shop got it this morning and already they are planning to get him something that will keep the old shop in his mind."

"I know a couple of fellows that are not going to fall over themselves getting in on it, and we are the fellows." Ben looked at Jake with a grin as he said this.

Jake grinned back as he replied, "For once you are off your reckoning. I am already in on it and they have my dollar. I wanted to give more but the boys who are running the thing wouldn't let me. What they want to do now is to keep it from getting to R. E."

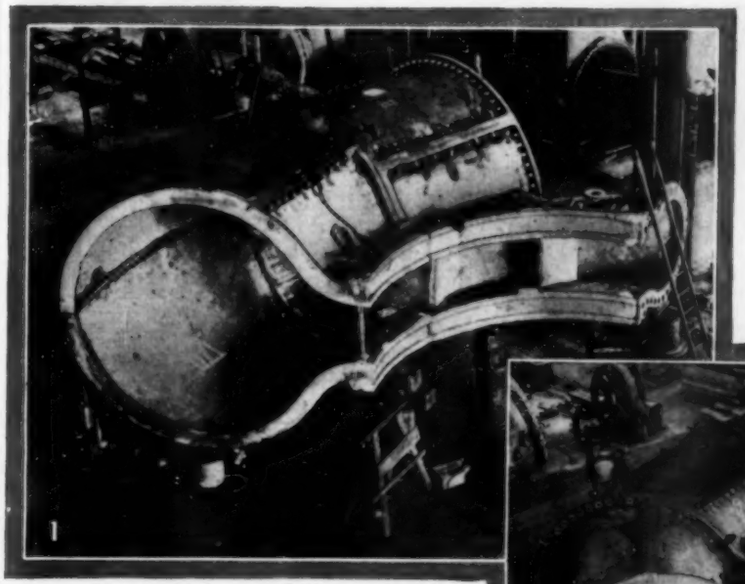
"But, see here, Jake, didn't you and I agree to fight this thing of giving presents to the bosses? If you go and help this thing along how are you going to head off the next thing that comes up?"

"I am just as much against giving presents to bosses as I ever was, and I have lost part of my respect for any boss that lets it be done, but this is a different thing entirely. R. E. will not be a boss when the boys give him the present, and what is more, he is never going to be one, not in a shop, anyhow. I am giving that dollar as a small token of my appreciation of past favors and not as an advance payment on favors that I expect to get when I do not deserve them. When a fellow chips in to get a present for his boss he very seldom does it for love of the boss. Either he does it for fear that he will not get a fair deal if he does not do it or else he thinks the boss will favor him more than he deserves if he does. I have been here quite a bit longer than you have been, and R. E. has been here all the while and I have never known him to take a present from the men, but I have known of times when he has sat down mighty hard on fellows who were trying to get up money for a present for some boss or other, including himself. The boys got the idea from him that to be popular with him they should raise money for a different kind of a fellow. One day a man who had not worked here very long started to raise money for a present for R. E. I think R. E. got on to it, but anyhow, there was a laborer working here that had a large family and he had had a lot of sickness among his children. R. E. went to the man that was raising the money and suggested that he raise a fund for the laborer, rather broadly hinting that if a fund was raised for someone around there who didn't need it, it would be a reflection on both the fellow who raised it and the fellow who received it. Raising that money for the laborer seemed to cure that man of any further desire for that kind of thing. He never raised another collection from the men as long as he stayed here, which wasn't very long."

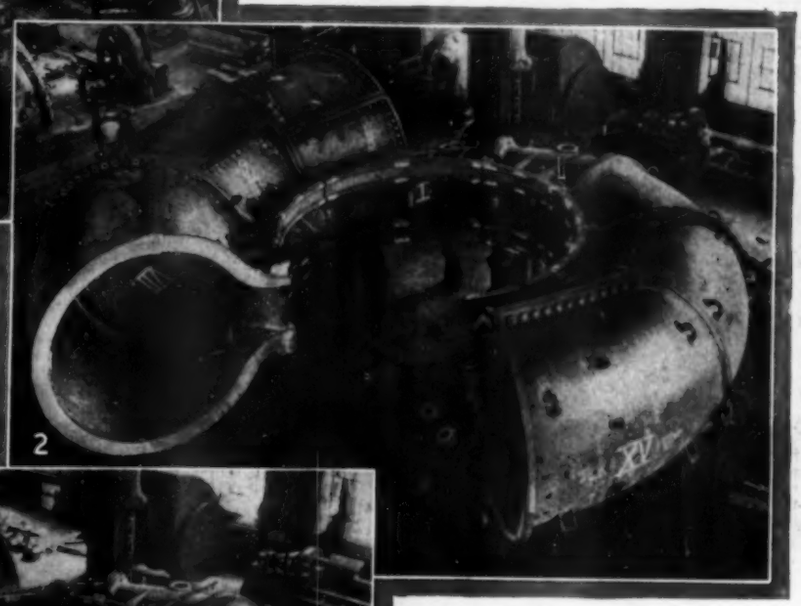
Ben handed Jake a dollar and said, "I guess that can go with yours without spoiling our agreement."

Assembling a 70,000-Hp. Turbine

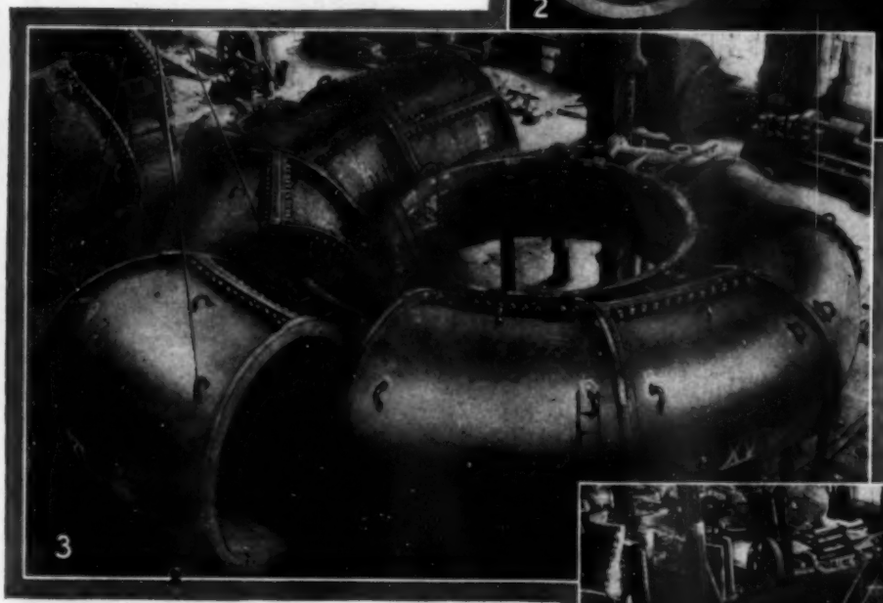
Photographs by courtesy of the Wm. Cramp & Sons Ship and Engine Building Co.



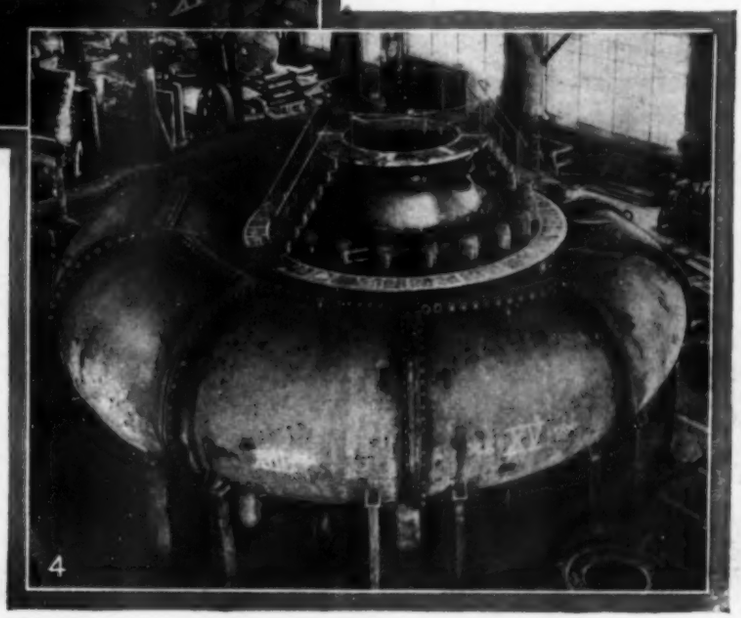
1—Two sections bolted together. Intake diameter is approximately 14 feet



2—Five more sections added. Inside diameter of casing is about 19½ ft. Casting 1½ in. thick



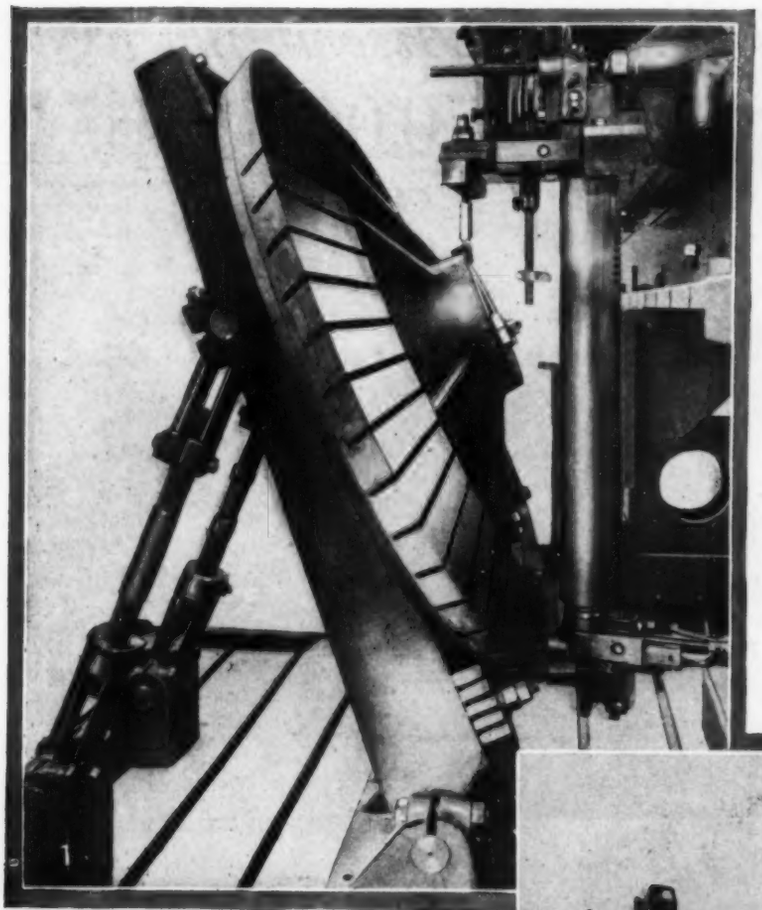
3—Swinging in the last section. Overall dimension is about 50 feet



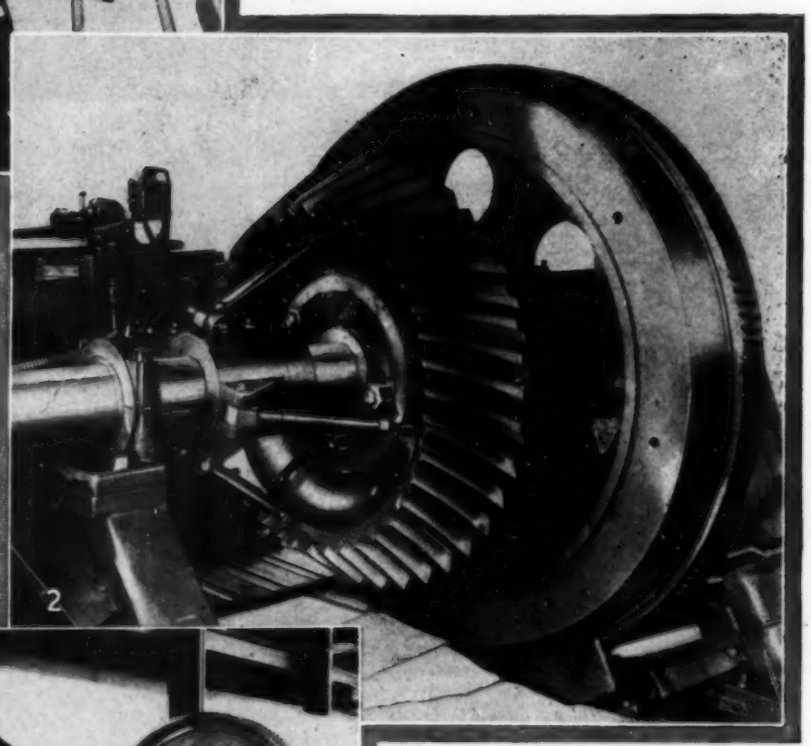
4—Turbine completely assembled

Gears That Must Stand Hard Service

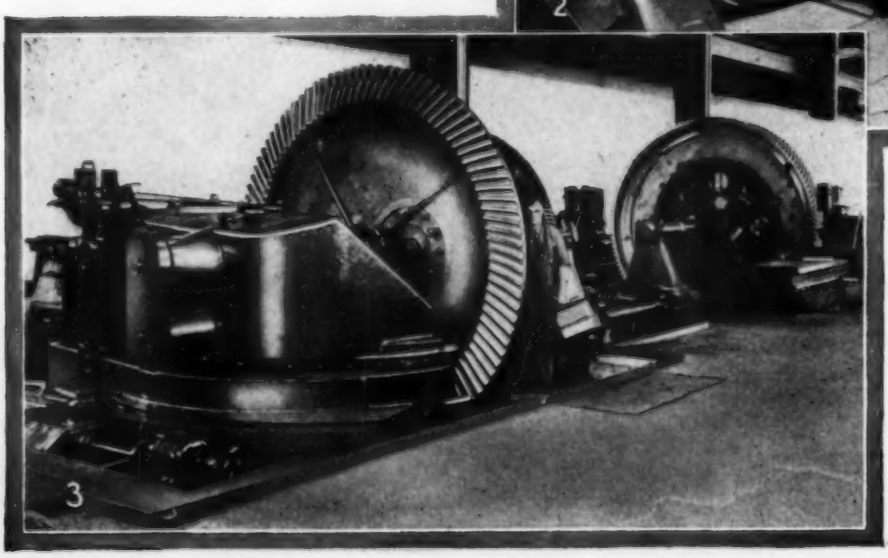
Photographs by courtesy of the Morgan Construction Co.



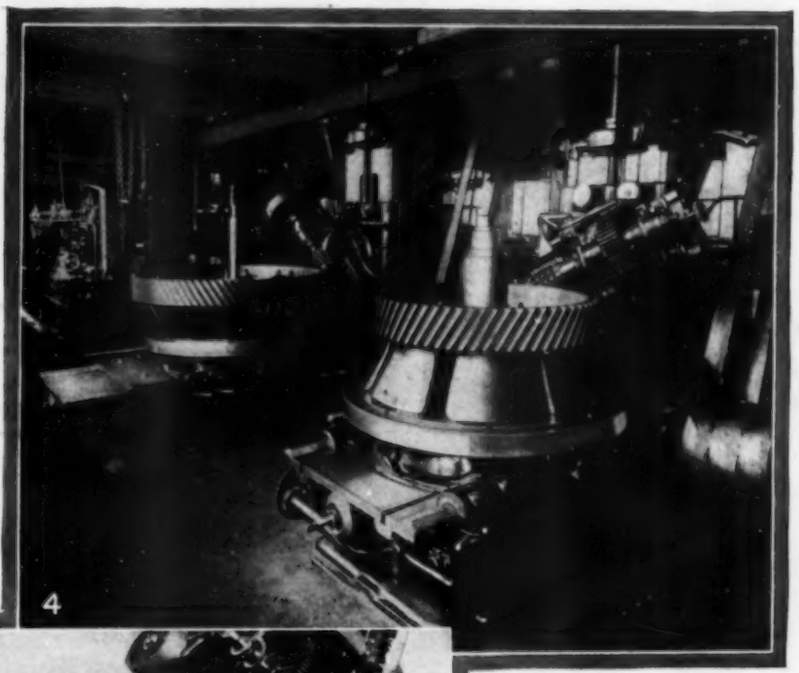
1—Gashing a bevel gear on a vertical shaper



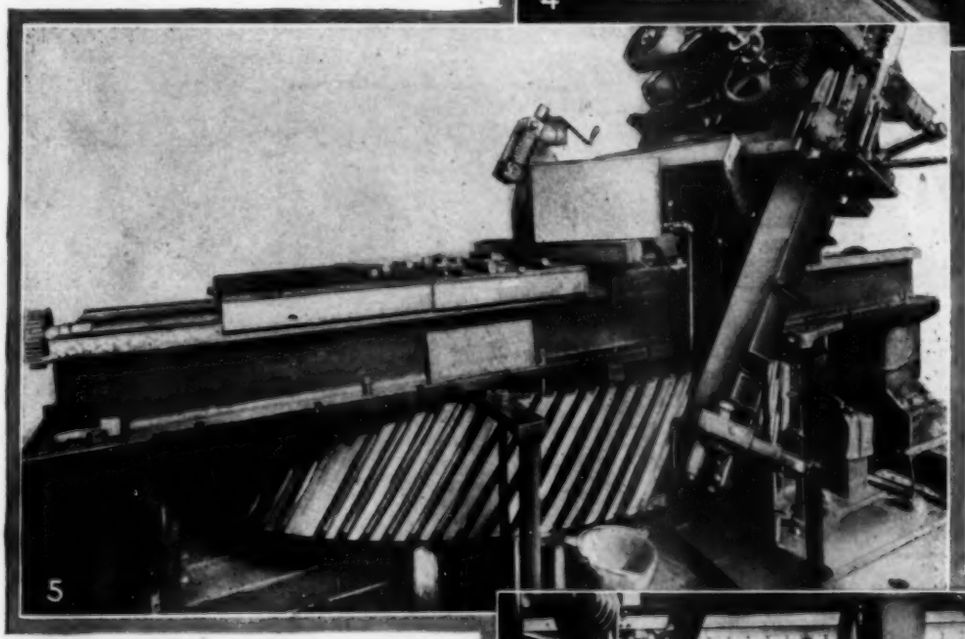
2—Generating a helical bevel gear



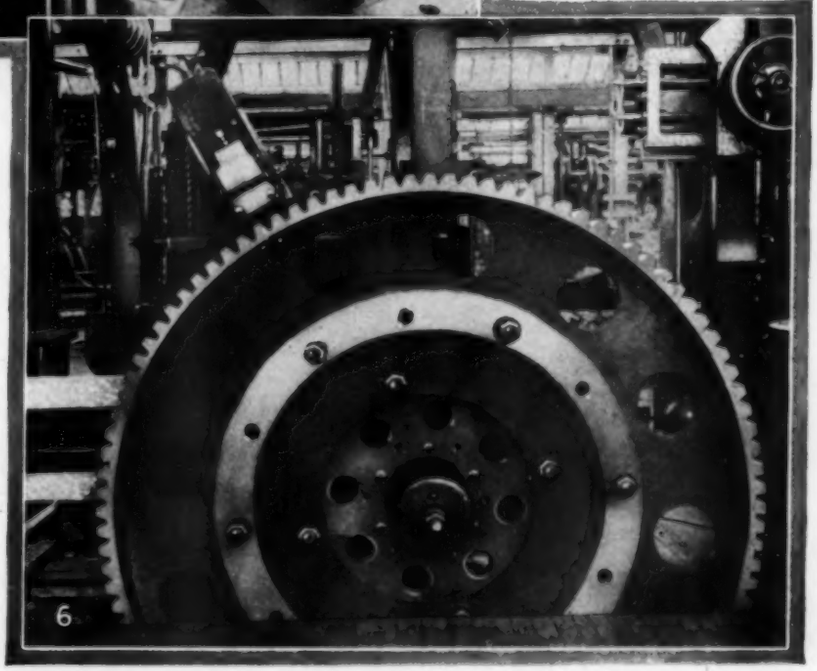
3—The gear on the machine in the foreground weighs approximately 15 tons



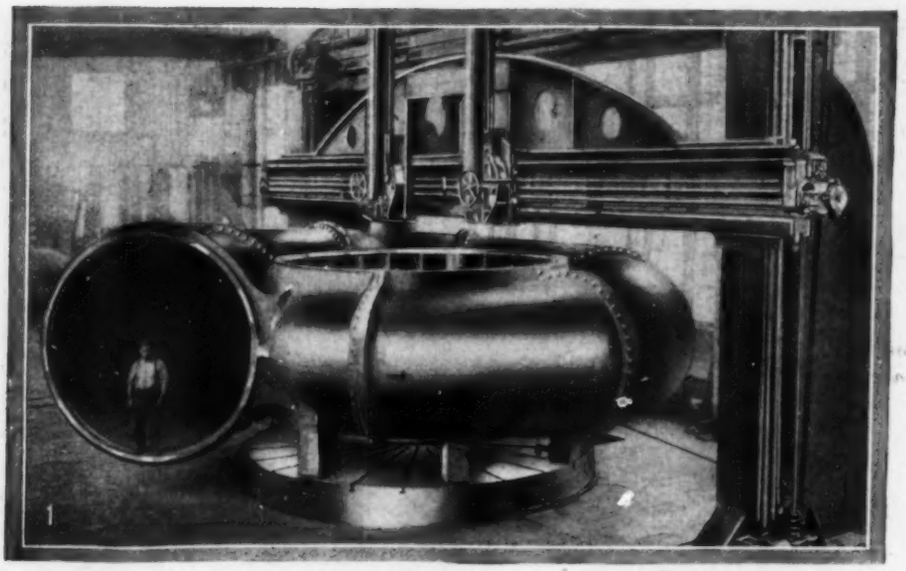
4—Generating helical gears



5—Shaping the teeth of a helical gear on a special shaper



6—Shaping the teeth of a large spur gear



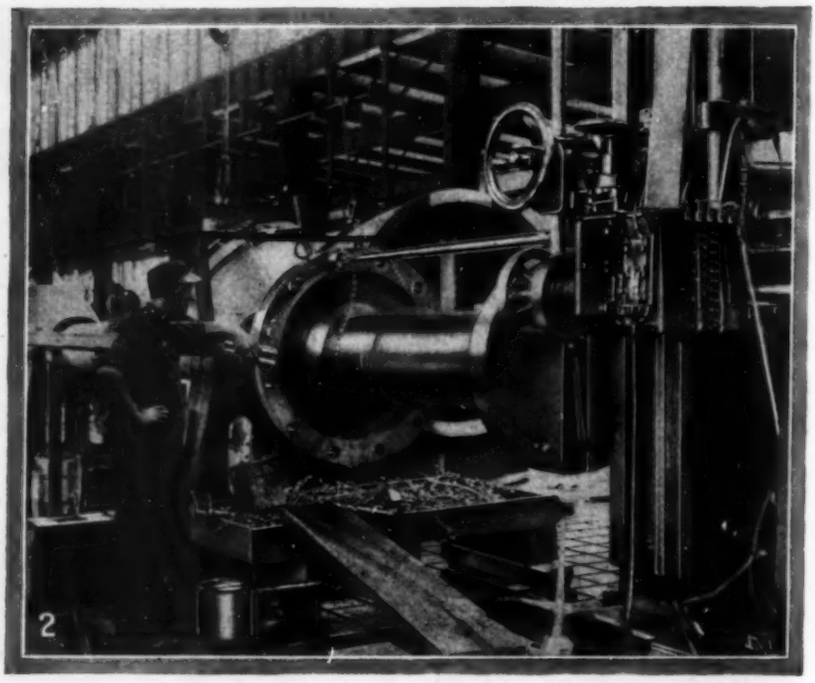
Photographs by courtesy of the S. Morgan Smith Co., York, Pa.

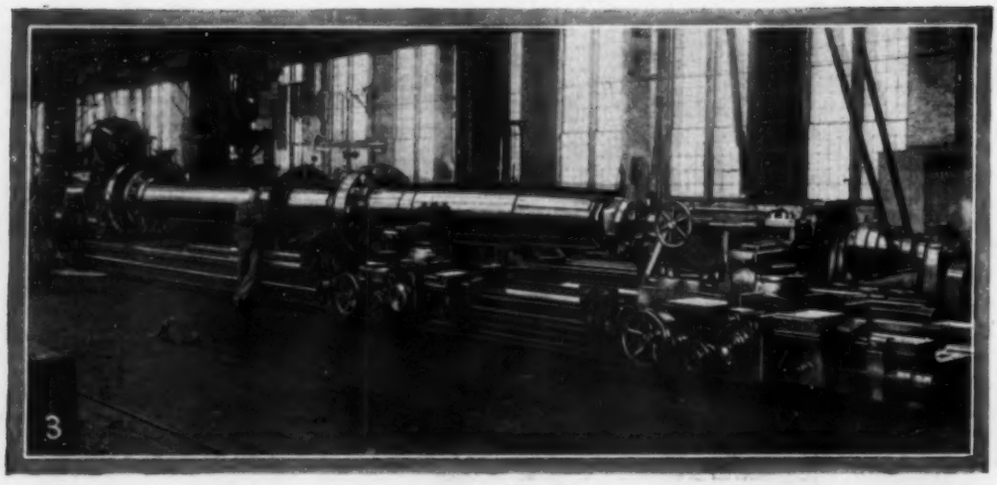
Large Boring Mill *and* Lathe Work

1—Machining complete spiral case for turbine

2—Drilling flange holes in turbine shaft, using loose bushings in jig plate

3—Final turning of large turbine shaft





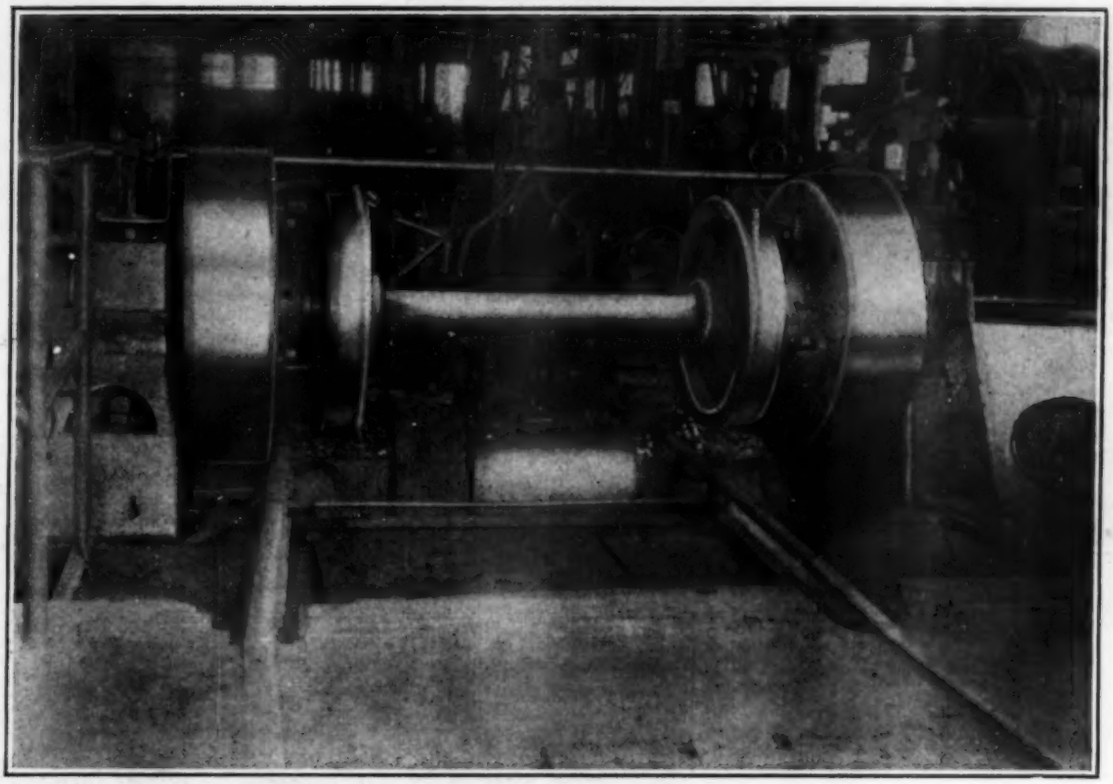


Fig. 1—Car-wheel lathe arranged for easy handling of the wheels to and from the machine

Machines and Tools of the U. P. at Los Angeles

By L. C. MORROW
Managing Editor, American Machinist

Handling car wheels without manual effort for turning and grinding—How some of the usual jobs are done—Small tools for miscellaneous operations

CONVENIENCE in handling heavy parts, to save time and manual labor, is one of the accomplishments of the Los Angeles and Salt Lake Rd., of the Union Pacific System, in its shops at Los Angeles, Calif. For example, the Putnam car-wheel lathe, Fig. 1, is set into a pit, bringing the centers down into a position where the operator can work from floor level. Rails from the storage tracks, Fig. 2, lead into the wheel shop and right up to the machine.

When the machine is empty, the head shown on the left in the illustration is run out about 12 in., so that as the wheels are rolled in they will clear the chuck. When the wheels have reached the center of the lathe, they are picked up in the chain-block sling shown, elevated to turning position and the head is run in. To unload, the sling is applied to the axle, the head is run out, and the wheels are dropped to the track. As shown in Fig. 3, there is an air-operated swivel provided for swinging the wheels to one truck or the other for offset storing.

Another arrangement of convenience is shown in Fig. 4, which illustrates a Niles car-wheel grinder set in a pit, with tracks provided for rolling the wheels into the machine. On account of the center drive of the machine, and because of the overhead works, a chain block and sling could not be used to handle the wheels from the truck into the chuck. As a substitute, two pneumatic jacks are used under the two short pieces of rail that constitute the end of the track. When the wheels are in position over the chuck, and the opening

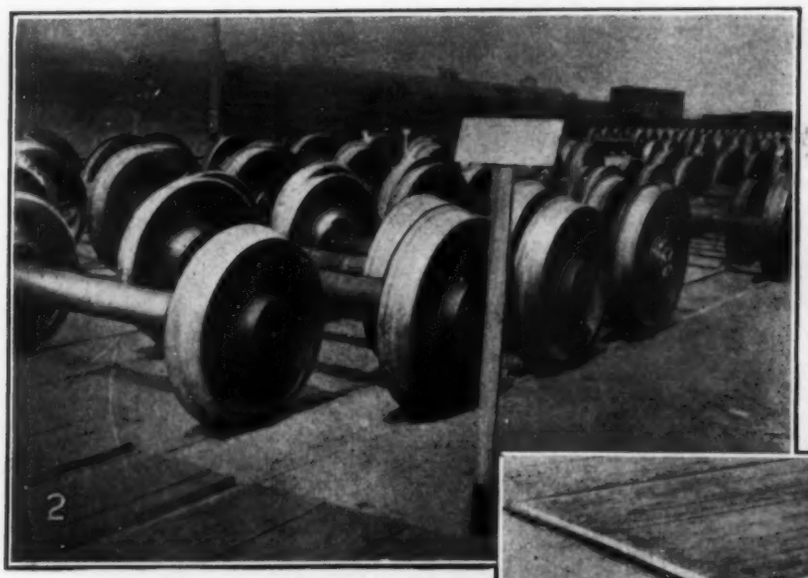


Fig. 2—Offset storage of car wheels

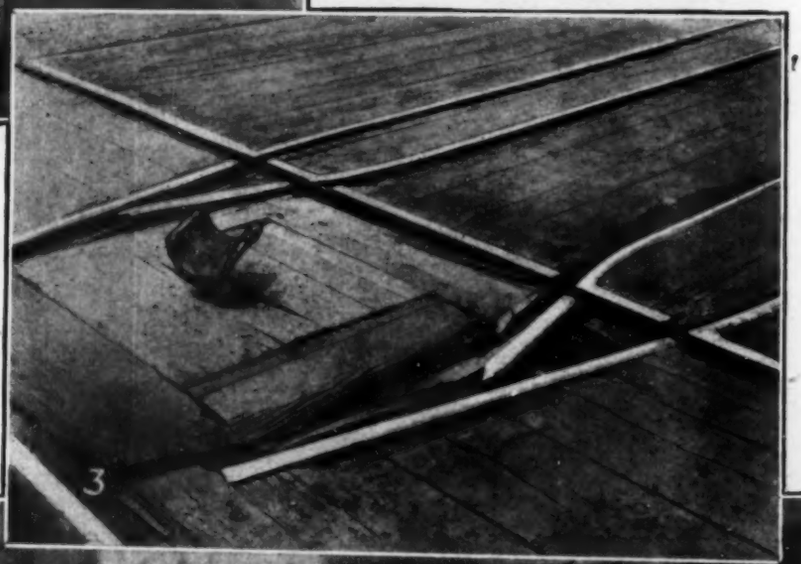
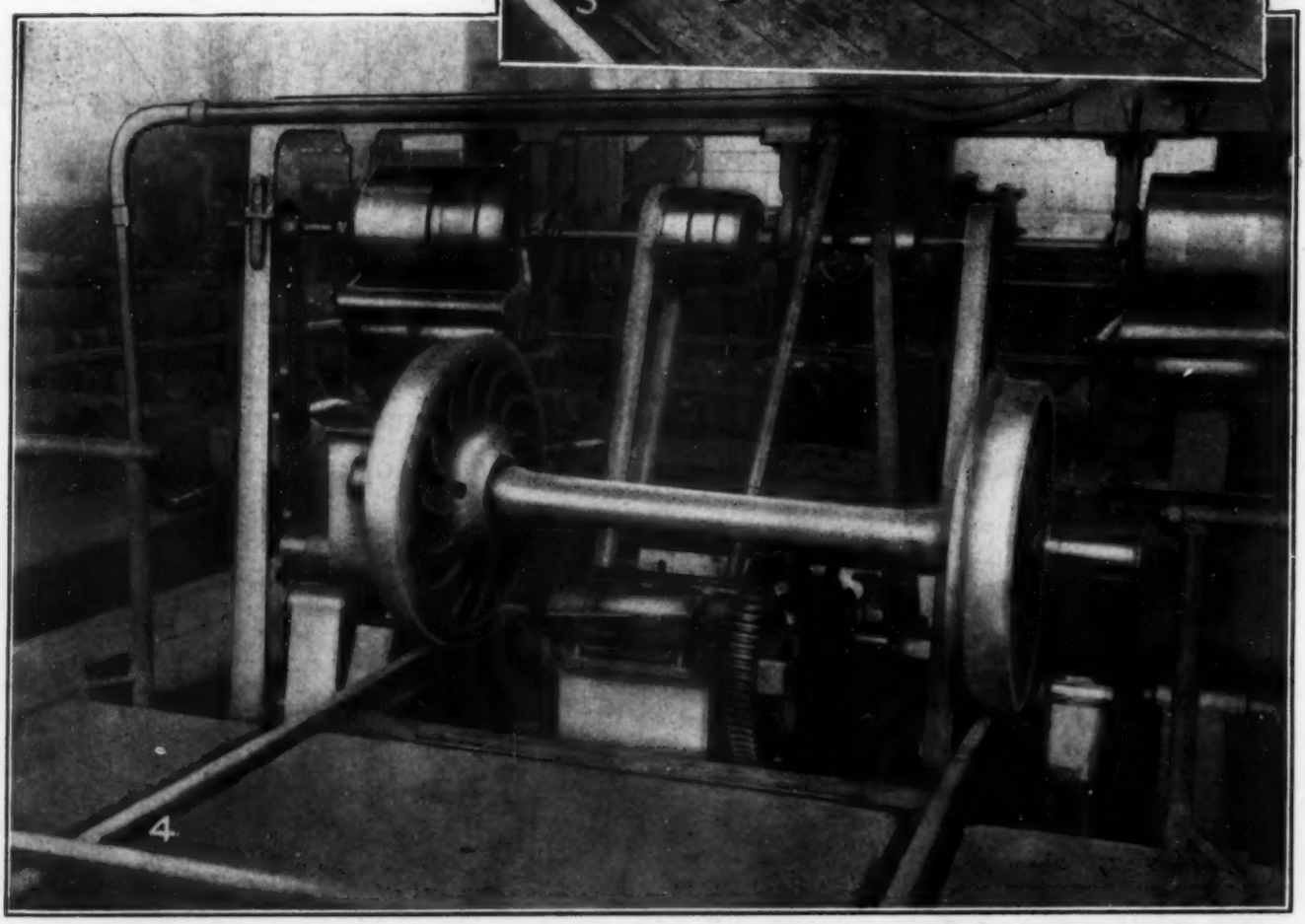


Fig. 3—Pneumatically operated swivel to facilitate handling of car wheels in offset storing

Fig. 4—Car-wheel grinder, into and from which the wheels are moved by pneumatic jacks



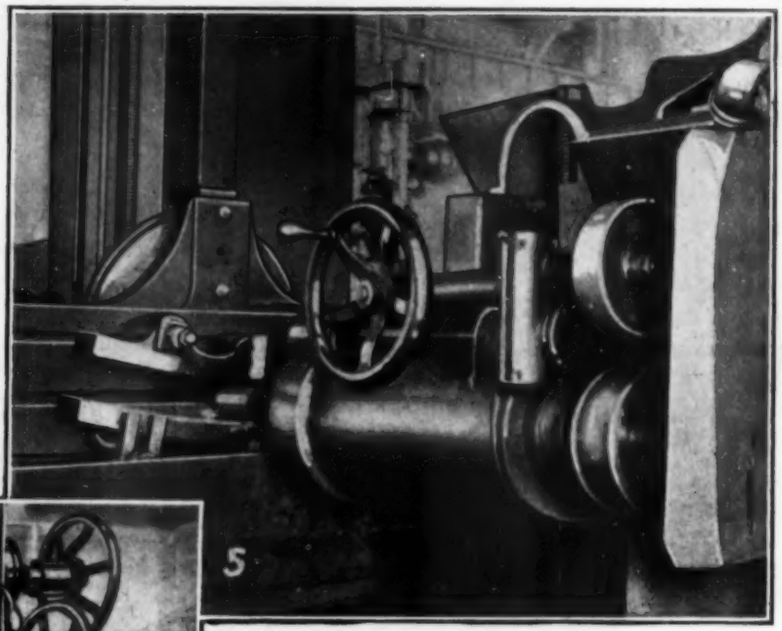


Fig. 5—Grinding a link

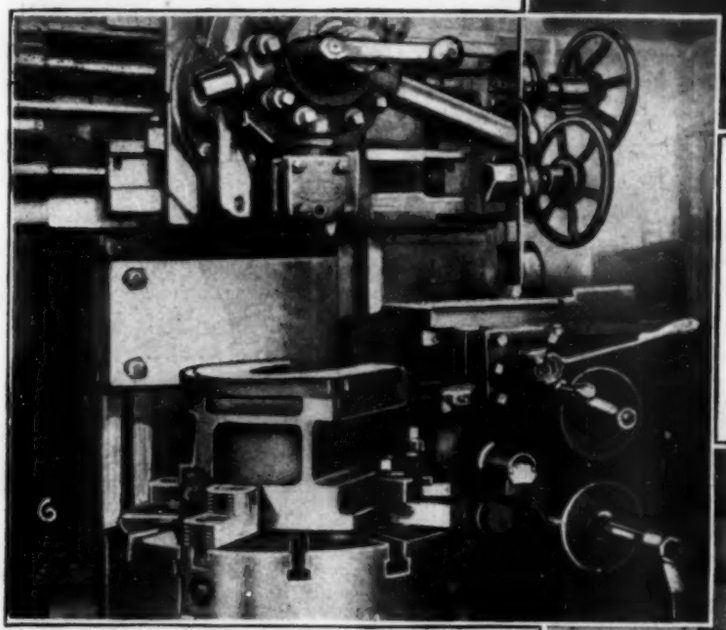
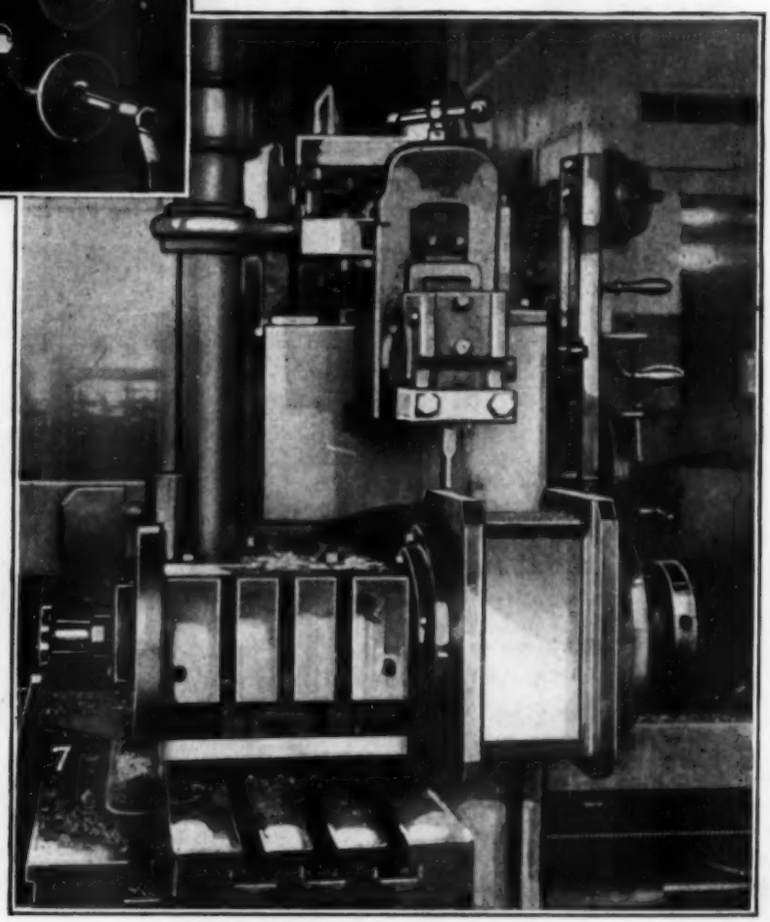


Fig. 6—Getting ready to face a driving-box hub plate

Fig. 7—Machining a main-rod brass



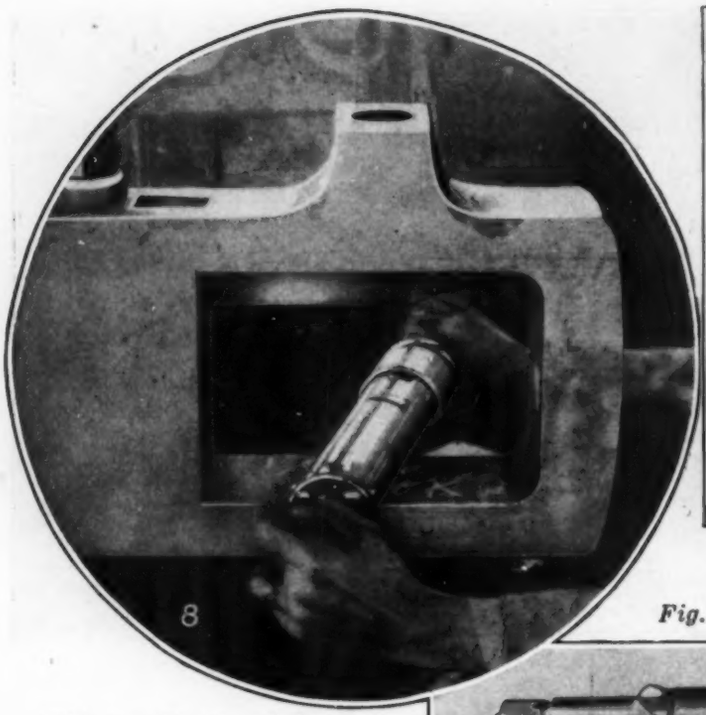


Fig. 8 — Finish-grinding the inside of a strap on a main-rod end

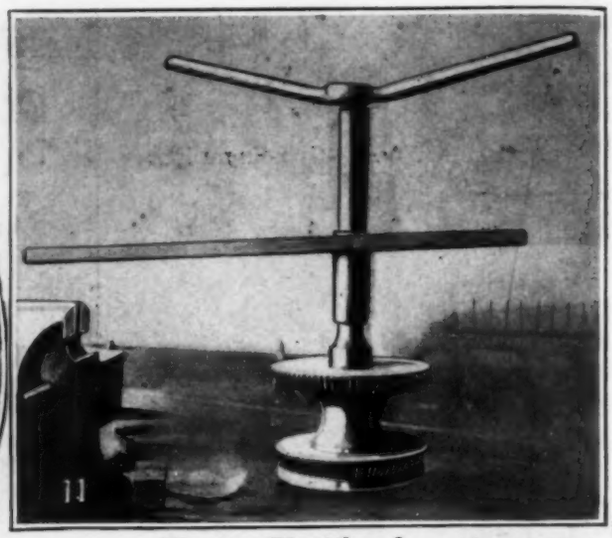
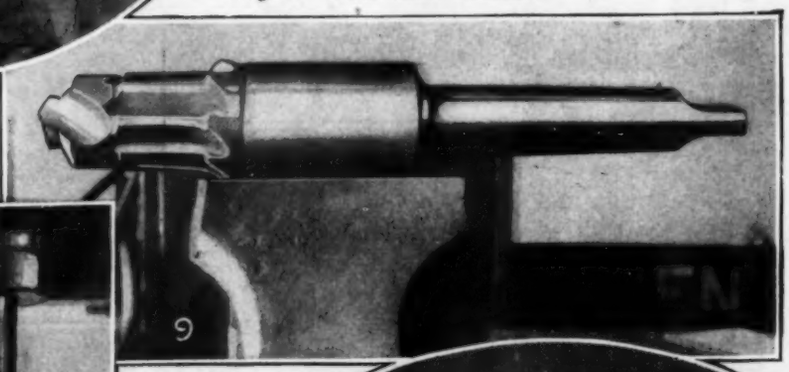


Fig. 11—Throttle-valve seat reamer

Fig. 9—Flue-sheet reamer



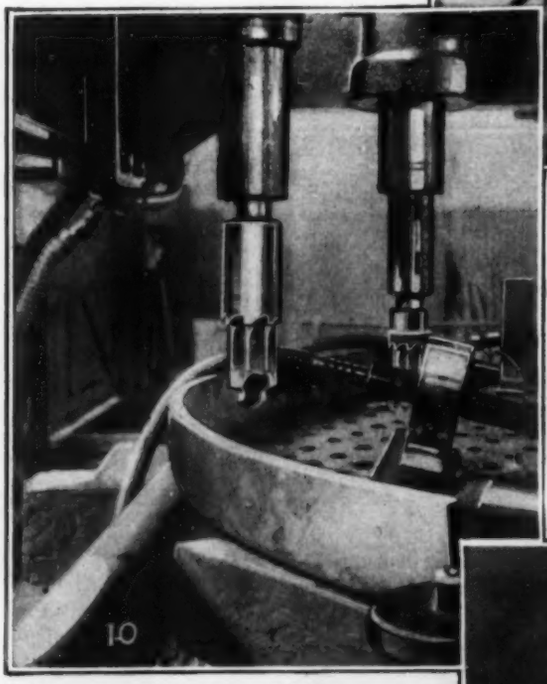


Fig. 10—Set-up for drilling, reaming, and countersinking flue sheets with the tool shown in Fig. 9

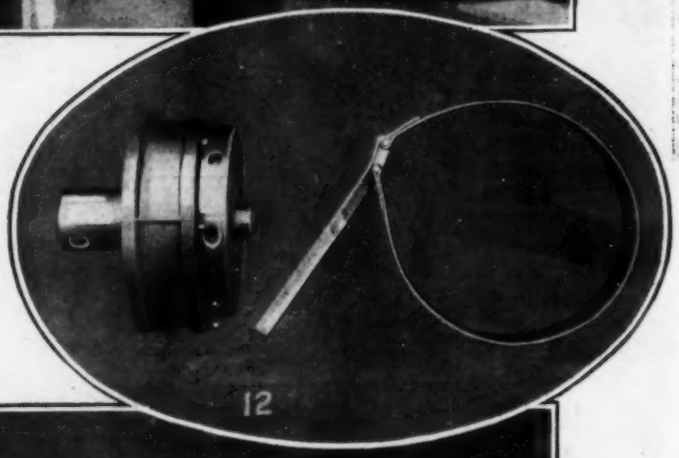


Fig. 12—Mandrel used in finish-turning valve rings, and clamp used in set-up

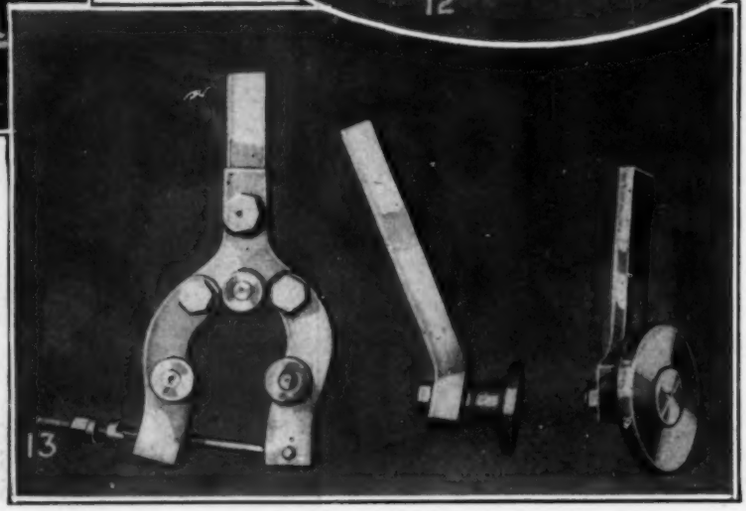
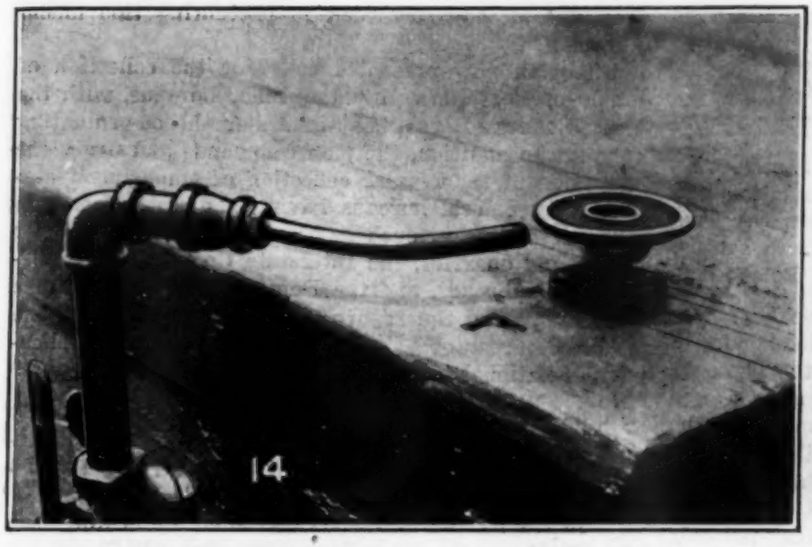


Fig. 13 — Tools for rolling axle journals, piston rods and crankpins



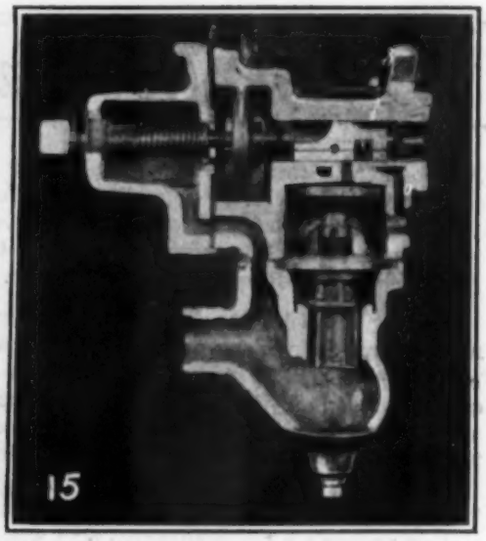


Fig. 14—Device used in cleaning emergency-valve seats. Fig. 15—Cut-through model of emergency valve

segment of the chuck worm has been thrown back, as shown in the illustration, the jacks are operated to lower the wheels. The operation is reversed when a pair of wheels is removed from the machine.

How links are ground, driving-box hub plates are faced, and main-rod brasses are machined, is shown in Figs. 5, 6, 7. The machines are the Sundstrand link grinder, the Bullard vertical turret lathe, and the Morton draw-cut shaper. The other work generally allotted to these machines is so handled in the Los Angeles shops.

Rod ends are finished on the inside, as shown in Fig. 8, by the Sheldon pneumatic grinder.

Among the special tools are the flue-sheet reamer, Figs. 9 and 10, the throttle-valve reamer, Fig. 11, the mandrel for turning rings, Fig. 12, the rolling tools, Fig. 13, and the device for cleaning emergency-valve seats, Fig. 14. The cut-through model, Fig. 15, shows the position of the emergency-valve seat in the valve.

Flue sheets are punched before the reamer referred to is used. The punched hole, which is smaller in diameter than the diameter of the end portion of the tool, serves to locate the reamer and to pilot it. The functions of drilling, reaming, and countersinking are performed by the tool. The machine used has two spindles that may be positioned within a limited range. While one tool is engaged upon its cut, the operator positions the other.

Throttle-valve seats are reamed in position by the throttle-valve reamer illustrated. The bar, shown about midway of the shank, is slotted, and in operation is bolted to an adjoining part of the locomotive, to act as a support.

Valve rings are made from a pot casting. The casting is finish-bored and rough-turned and the rings are then cut off. That operation is followed by a milling cut $\frac{1}{16}$ in. wide, to slit them, after which they are mounted on the mandrel illustrated, for finish-turning. While they are being clamped by the setscrews from the side, the rings are squeezed by the clamp shown to the right of the mandrel in the illustration.

The roller tools are used for rolling axle journals, piston rods, and crankpins. All have been found to give a very satisfactory finish and to stand up well in service.

As can be seen from Fig. 15, the emergency-valve casting shown in Fig. 14 has several ribs. It is against these ribs that compressed air is blown, Fig. 14, to cause the casting to revolve on a pin supported on the bench. A high speed is attained, and the operation of cleaning the seat is performed in a few seconds. The dirt is removed by a piece of abrasive cloth held in the hand of the operator. The bronze will, in fact, take a fair polish within a very short time.

Climbing out of the Rut—Discussion

By W. J. Emery

"AND the machine tool trade has it all over the textile machinery business," says I, after reading Entropy's article on page 517, Vol. 65, of the *American Machinist*. Weaving looms today, for example, are built practically as they were 50 years ago.

Loom design has advanced somewhat in the details of the parts and in the addition of attachments, but the basic ideas of loom motions have not changed one whit from what they were nearly a century ago. Ninety-nine per cent of fabrics today are produced on fly-shuttle looms that throw the shuttle from the end of a stick through the opened shed in the warp, just as it was done in England in 1733 by Kay.

Looms are still largely built by the use of the hammer and cold chisel, and with most of the surfaces not fitted at all. Straight-line and conveyorized production is almost unknown in textile machinery. Every machine is built by itself and its parts are not interchangeable. Friction and misalignment run rampant in looms. Only about half of the power put into a loom is actually used in handling the filling and warp threads.

The loom building industry, more than any other branch of the mechanical trades, needs to hire in as many young technical engineers as it can carry, to produce complete new designs of looms from the floor up. This would result in entirely new types of weaving machinery similar to the new types of machine tools, the enormous production possibilities of which are so well known. Worsted looms produce about 1½ in. of cloth per minute, the same as 50 years ago. Greater production is due to devices that keep the loom running or prevent defective goods.

Book Reviews

Employment Statistics for the United States. By Ralph C. Hurlin of Russell Sage Foundation and William A. Berridge of Brown University. Two hundred and fifteen pages, 6x9½ in. Cloth boards. Published by Russell Sage Foundation. Price $2.50.

Bearing a warning to American industry that a business slump and widespread unemployment following a protracted period of prosperity (such as the present) can be avoided only by careful management and through accurate current knowledge of industrial conditions, the 200-page report on "Employment Statistics for the United States" just issued by the Russell Sage Foundation in co-operation with the American Statistical Association presents a comprehensive plan whereby not only the major industries, such as manufacturing, mining, transportation, communication, and agriculture, but industry and commerce in general may be furnished with a guide toward the prevention of over-production and over-extension of credit, the principal causes of business slumps and extensive unemployment.

Detailed knowledge of the trend of unemployment is at the base of the plan which calls for the co-operation of Federal, State and other governmental agencies with such industries as iron and steel, automotive, textiles, chemicals, paper, lumbering, construction and merchandising. The report is also in the nature of a handbook of methods for the collection and maintenance of employment statistics recommended by the Statistical Association's Committee on Governmental Labor Statistics. It was prepared by Ralph G. Hurlin, director, Department of Statistics, Russell Sage Foundation, and William A. Berridge, associate professor of economics at Brown University.

Declaring that the volume of employment invariably reflects the condition of business, the report quotes the statement of Secretary of Commerce Herbert Hoover that "As the slumps in business are in the main due to the wastes, extravagance, speculation, inflation, over-expansion, and inefficiency in production developed during the booms, the strategic point of attack, therefore, is the reduction of these evils, mainly through the provision for such current economic information as will show the signs of danger and its more general understanding and use by producers, distributors and banks, inducing more constructive and safer policies."

For the manager of an industrial company, the proposed statistics would make possible comparison of his own plant with others in his industry; they would give him an index of activity in the industries from which he buys, and in those businesses to which he sells, and some knowledge of the purchasing power of the ultimate consumer. The manager would then, the report says, "be enabled to develop enlightened policies in regard to employment in his own plant, and to eliminate wasteful fluctuations in his own labor force."

Unemployment statistics would also be of great value to government officials, the report indicates. It would permit them to time public works and public finance, to relieve conditions of unemployment, and where necessary it would enable them to stimulate and prepare for the relief of unemployed if business men and financiers have not already succeeded in preventing this unemployment.

The plan now presented calls for the collection of employment statistics by state labor bureaus, with the United States Department of Labor the co-ordinating center. In addition, the plan commends and urges the extension of the regular collection of employment statistics by federal bureaus having a direct relation to certain industries, such as the Geological Survey for mines and quarries, the Interstate Commerce Commission for railroads, and the Department of Agriculture for farms, and the reporting of all these data to the Federal Bureau of Labor Statistics for prompt publication of national indices of employment.

Fundamentals of the Locomotive Machine Shop. By F. M. A'Hearn, assistant general foreman, Bessemer & Lake Erie R.R. Two hundred forty-two pages, 4⅝x7¾ in., flexible covers, illustrated. Published by the Simmons-Boardman Publishing Co., 30 Church St., New York City. Price $2.50.

"Elementary" is the word that probably best describes this book. It is suitable for study by the railroad repair shop apprentice, but not sufficiently advanced to be of much value to the observing mechanic or machinist who has passed his apprenticeship by several years. The halftone illustrations are, for the most part, so lacking in detail as to be almost worthless. Line cuts are well executed. Proofreading is not above reproach.

Of the twenty chapters, ten are devoted to a combination of explanations of the principles of construction of the machine tools ordinarily used in the railroad machine shop, and the application of the machines to a few of the common repair jobs. Four chapters deal with shop location and arrangement, the setting of machine tools, belting, and shop operation. Six chapters treat of rod, driving-box, brass-room, and motion work, tool grinding, and miscellaneous tools. There is an appendix that gives tabular matter, most of which is used by, and is of value to, the railroad shop man.

The author wrote the book to meet the needs of the beginner, the advanced workman, the supervisor, the machine shop foreman, members of the engineering department, and those not directly engaged in machine shop work. The indications are that he has underrated all of those to whom he wishes to appeal except the beginner and the group not directly engaged in machine shop work.

Machine Design Problems. By S. J. Bernard and E. O. Waters. One hundred eighteen 6x9-in. pages, cloth boards. Illustrated. Published by D. Van Nostrand Co., 8 Warren St., New York. Price $1.50. This book of problems is intended to supplement the book, "The Elements of Machine Design," recently published by the same authors. For convenience, the subject matter follows the same arrangement adopted in the textbook, chapter by chapter. Three classes of problems are presented: the first calls for a solution by calculation involving the theory of design, the second for free-hand sketching, while the third involves working drawings. The subjects covered include fastenings of all classes, shafting, couplings, bearings, belting, pulleys, spur, bevel, worm, and screw gearing, cams, linkage, pistons, stuffing boxes, and many kinds of pipes and fittings.

Standardized Practice Simplifies Die Design

By FRANK W. CURTIS
Western Editor, American Machinist

Knurling, shaving, drawing and forming tools—Shaving die arranged to handle six parts—Stock allowances made for shaving

AMONG other points considered in the designing of dies at the National Cash Register Co. is to arrange dies to accommodate several different parts when the operations to be performed are of a similar nature.

An example of a shaving die, arranged to handle six type-wheel racks, that are similar in outline, but different at the point of shaving, is illustrated in Fig. 19. The work is located on the slide *A* by two studs and the spring pin *B*. The slide is located on the die shoe by the plug *C* that fits corresponding bushings in the die shoe. Locking of the slides in the desired position is obtained by the gib *D*, operated by the screw *E*. The screw has a shoulder that fits a groove in the gib. The portion of the work to be shaved projects over the die *G*. To afford rigidity, the shaving punches for the outer and inner faces of the work have heels that enter the die before the shaving takes place. The different positions of the slide are shown dotted at *H*. A plan view of the punch holder is illlustrated to the right.

Shaving allowances in punching steel are proportioned in accordance to the thickness of the blank and the number of shaves required. If too great an amount of stock is removed from the blank the benefit of shaving is lost. Approximate shaving allowances used in this plant are shown in the table. For example, a 0.5-in. hole in ¼-in. sheet punching steel would be pierced to 0.476 in., then shaved to size, where only one shave is required. For a hole of the same size, requiring two shaves, the pierced size would be 0.464 in., the first

Conclusion. The first and second parts were published on pages 57 and 169, Vol. 66.

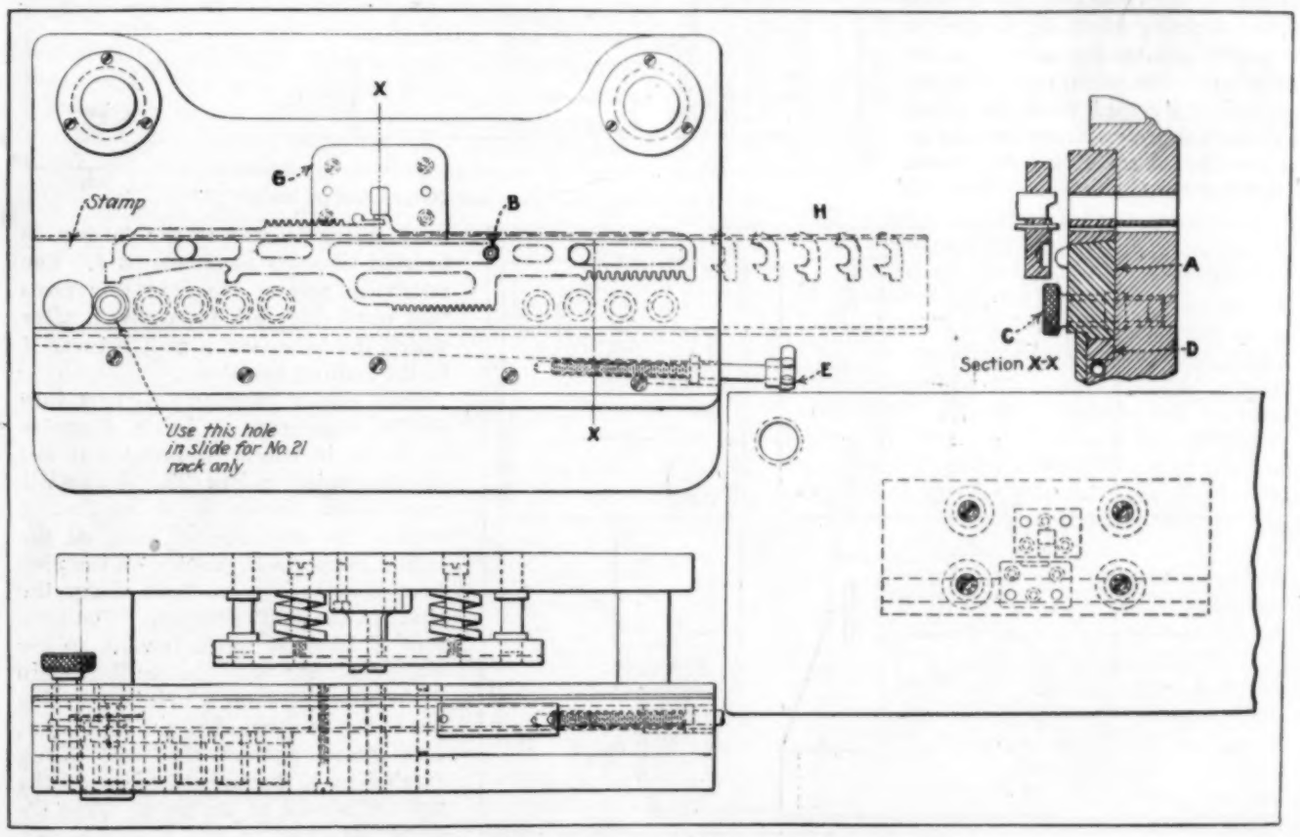


Fig. 19—Shaving die accommodating six sizes of work

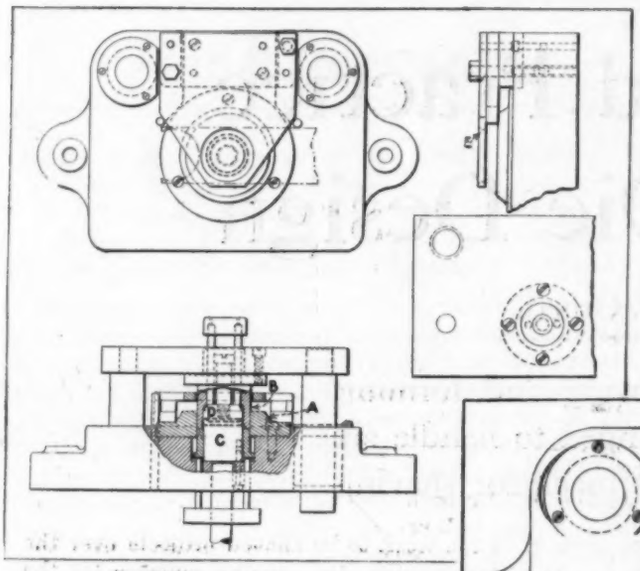


Fig. 20—Blank and drawing a counter wheel

shave 0.488 in., and the second shave to size.

Aluminum counter wheels are blanked and drawn in the die illustrated in Fig. 20. The material is 0.0165 in. thick, 2¼ in. wide, and the finished part is 1½ in. in diameter. A standard die-shoe assembly is used. The blank is cut by the die *A* and the punch *B*, then it is drawn over the spring pad *C* by the inner surface of the punch. The concaved top is made by the forming block *D*, located in the punch, and the top portion of the spring pad. The scrap portion of the material is stripped from the punch as it is withdrawn from the die by the plate *E*. A restriking die is used to finish-form the wheels. This die merely squares the rim and reduces the radii of the concaved form.

In Fig. 21 is illustrated a die arranged for forming a right-angle bend in a ledger lever. Its principle differs from the usual form of bending dies. The end of the work to be twisted is inserted in the slot *A* of the revolving former *B*, and the opposite end fits a V-shaped nesting plate, while the pin *C* is the third locating point. In the punch holder are located two plungers that function as follows: The plunger *D* enters the die first and causes the sliding plate *E* to move forward so that its projecting end extends over the work. Then the angular end of the plunger *G* strikes the cam *H*, fastened to the revolving former, and turns it 90 deg. The

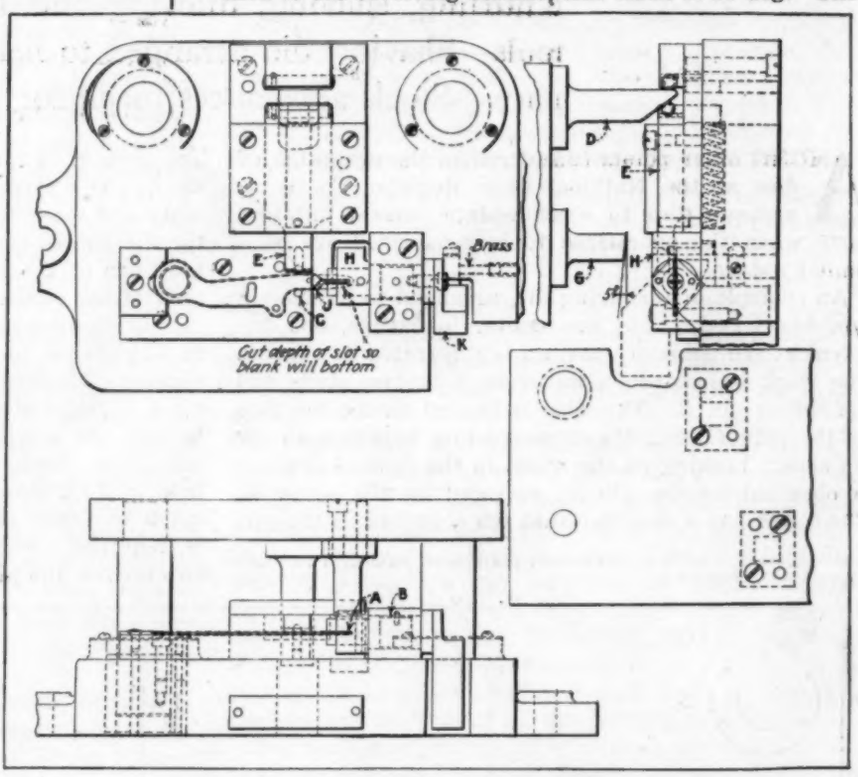


Fig. 21—Die that twists end of lever

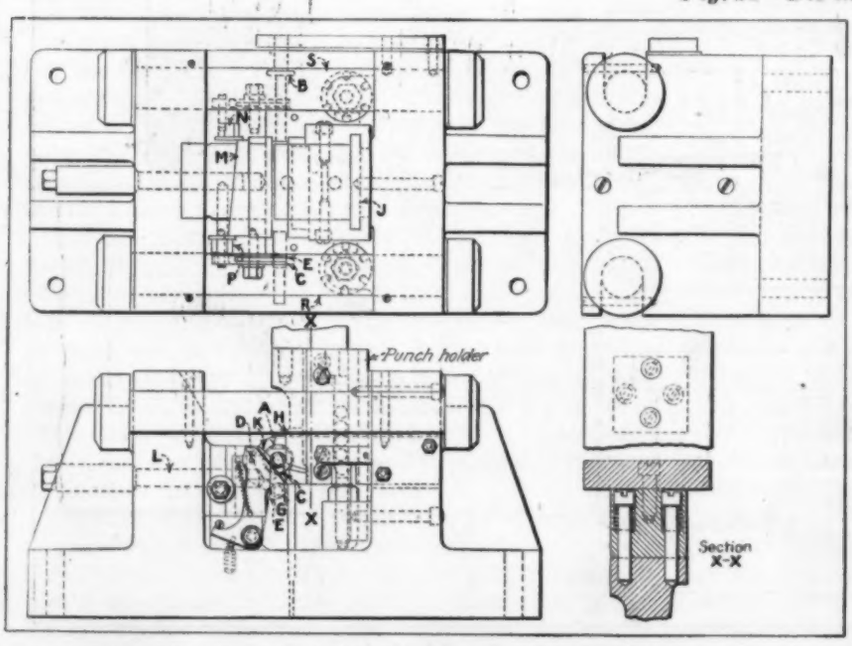
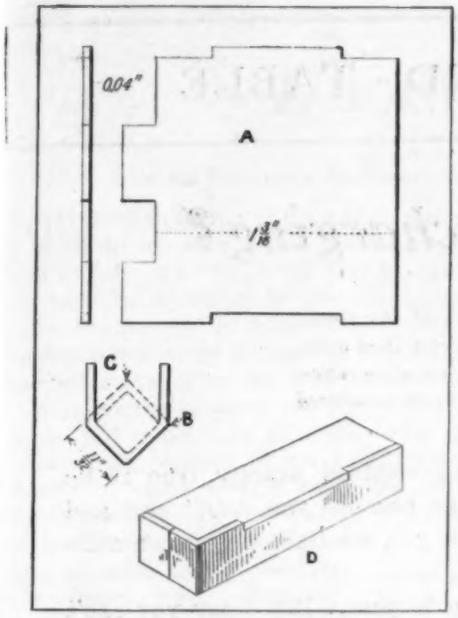


Fig. 22—Press tool for knurling armature shafts

work, being located in the former, is twisted likewise as shown at *J*. The revolving former stays in this position until the work is removed, after which the balancing arm *K* returns it to its loading position.

The center portion of armature shafts, measuring $\frac{9}{16}$ in. in diameter by 3¼ in. in length, is knurled in the die illustrated in Fig. 22. A shaft is inserted as shown at *A* so that it strikes the stop *B*. It rests on the spring supports *C*, pivoted on the pins *D* so that they move from under the shaft as the shaft descends. The ejectors *E* likewise move inward as the work descends until the shaft reaches the position *G*, after which they spring out to the position shown. These ejectors guard against the work being carried back through the dies on the upward stroke of the press. The die *H* is attached to the punch holder, which is guided by the hardened plate



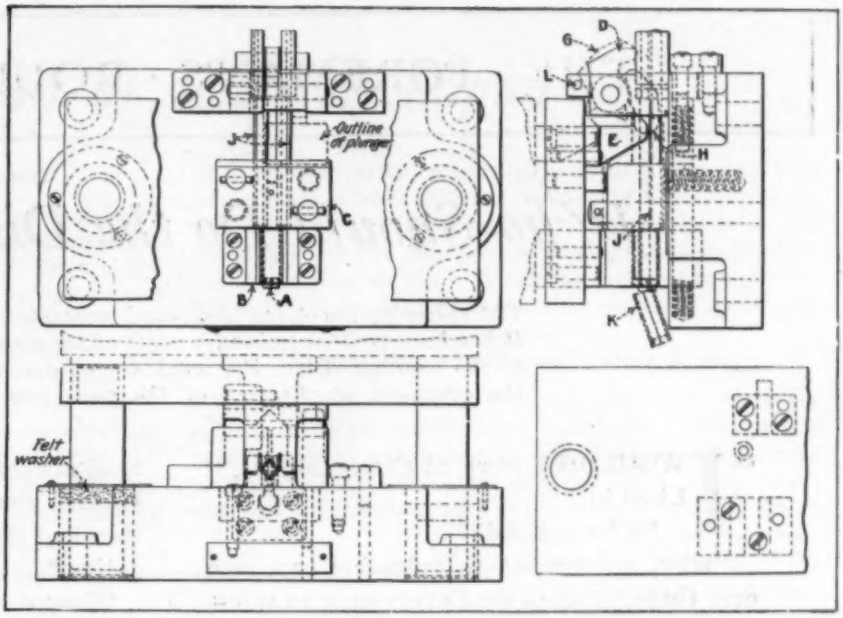


Fig. 23—Sequence of operations for motor-brush tube. Fig. 24—Second forming die for tube

J. Five rollers, mounted between the punch holder and the plate, take the side thrust. The die *K*, held in place by the screw *L*, is adjusted by the tapered slide *M*, that is moved either forward or backward by the collar screws *N* and *P*. Two tie pins *R* and *S* support the vertical portions of the die shoe against the strain set up during the knurling.

Motor-brush tubes are made of brass 0.04 in. thick, as shown in Fig. 23. The blank is illustrated at *A* and the tube, after the first form has been completed at *B*. The dies used for these operations are simple in construction. The second form closes the work as seen at *C*. Close-in of the ends completes the tube as outlined at *D*. In Fig. 24 is illustrated the second forming die, in which the work is placed on the square arbor *A*, located above the lower die block *B*. The arbor is attached to the floating block *C*. The upper die block is V-shaped and closes the projecting sides of the tube when the dies are closed. A feature of the die is the ejector arm *D*, operated by the plunger *E*. As the punch descends, the plunger strikes the trip of the arm and forces it to the position *G*. When the plunger has passed it, however, the arm returns to its normal position. Then, on the upward stroke, the arm is moved by the hooked portion of the plunger to the position shown at *H*. This rapid movement causes the plate *H*, to which the two pins *J* are attached, to be moved forward rapidly and to eject the work as shown at *K*. A helical spring returns the plate and pins to their normal position. The pin *L* controls the upward movement of the ejector arm.

Allowances For One or Two Shavings

Thickness of Stock	Allowance for One Shave	Allowance for Two Shaves 1st Shave	Allowance for Two Shaves 2d Shave	Thickness of Stock	Allowance for One Shave	Allowance for Two Shaves 1st Shave	Allowance for Two Shaves 2d Shave
0.035	0.005	0.005	0.004	0.135	0.014	0.014	0.006
0.049	0.006	0.006	0.004	0.146	0.015	0.014	0.006
0.058	0.007	0.007	0.154	0.017	0.017	0.016	0.006
0.064	0.007	0.007	0.005	0.182	0.018	0.016	0.007
0.072	0.008	0.008	0.005	0.185	0.020	0.016	0.007
0.089	0.009	0.009	0.005	0.1875	0.020	0.018	0.007
0.098	0.01	0.01	0.005	0.2	0.025	0.018	0.007
0.015	0.01	0.01	0.006	0.22	0.025	0.020	0.007
0.109	0.012	0.012	0.006	0.3125	0.025	0.022	0.007

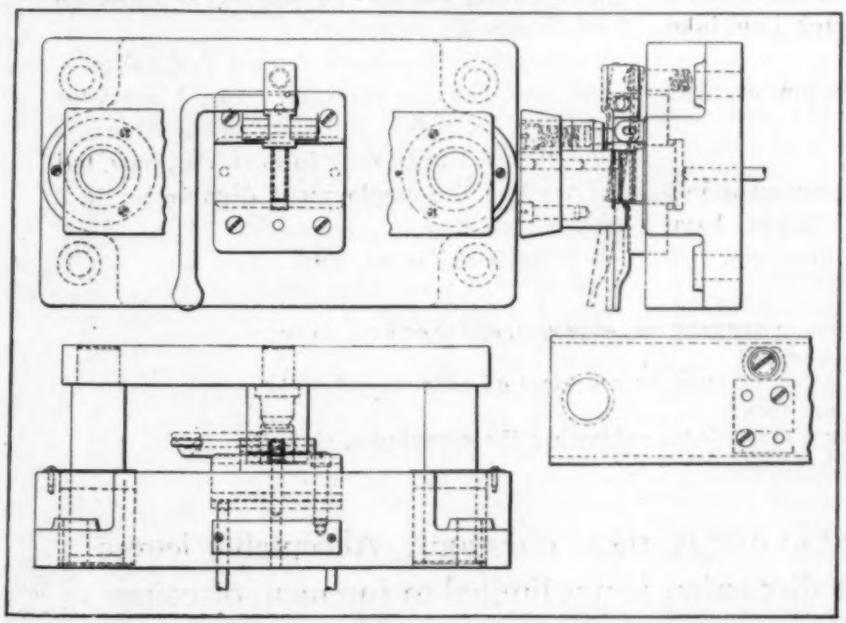


Fig. 25—Die that closes end of tube

The ends of the tube are closed in the die shown in Fig. 25. A floating mandrel, used to locate the work is utilized. The handle is operated to tip the mandrel is an upward direction so that the work can be assembled readily as shown. Then, as the punch descends, the mandrel and work are carried down so that the forming blocks bend the projecting ends of the work.

THE · FOREMAN'S · ROUND · TABLE

Who Should Do the Discharging?

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"I WOULDN'T work at Carrigan's, Al, if I had to."

"Why not, Ed?"

"Why, a foreman can't fire his own men over there. Has to send every man he wants to get rid of to the employment department, with answers to about twenty-five questions. And next day he may find him working in the next department. Not for me!"

"Hold on, now, Ed. I don't see anything wrong with that method of discharging."

"You don't? If a fellow isn't good enough for you, do you think I want him in my gang? And do you think a fellow who sits in the office has any right to tell me to find him a job?"

"Ed, did you ever have a job where you just couldn't make a showing? Boss kinda rubbed you the wrong way all the time? Men around you didn't appeal to you? Work you had couldn't keep you interested?"

"Yes, and I quit. Didn't have any trouble getting another job, either, though I did take less money."

"Tell the new people where you worked last?"

"Sure."

"And that means your old foreman didn't say anything against you. Might have been a different story if he'd fired you. It wouldn't have sounded exactly true if he had let you go because you didn't suit and then had given you a satisfactory recommendation."

"Something to that. But I say you can't keep a good man down."

"You were kept down—at any rate you got less money for a year or so. Now suppose you'd had a chance to be transferred instead of fired. You already knew the product, the men, bosses, storerooms, shop system, and a whole lot more that you had to learn at the new shop, and you'd have been worth just about the same money you were getting. And on the other hand, suppose you had been fired, and had had to look six months for a job, or move your family to another town. You would have been away behind—the company that fired you would have lost money on a new man, and the company that hired you would have lost money in breaking you in. By the way, I think I'll let Hogan go Saturday."

"Hogan? You know I want that fellow—got just the job for him. Yes, I see your point. All right, you win. Only thing is you'll turn Hogan over to me direct now, but if we had the employment department he'd come that way."

"That's the point, Ed."

Is it advantageous to company and employee, either or both, to transfer rather than discharge?

Al has named a few of what he considers advantages. Are there others and what are they?

If you think the disadvantages outnumber the advantages, state the disadvantages and explain.

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Should Foremen Be Good Actors?

NO ONE in trying to get a high-strung nervous horse to do his best would start in by either exciting him unduly or by angering him but would, as tactfully as possible, endeavor to get the horse to understand what was wanted of him. The results obtained would be dependent very largely on how well the driver had succeeded in making the horse understand his wants.

Now man is a much more sensitive creature than a horse and is not only deserving of a more careful approach but, because of his keen reasoning power, demands it. In a certain sense we all need sometimes and most of us all the time to practice acting instead of yielding to our natural or first impulse in approaching our fellow man. However, we are sure to make a failure of it if we try to ape the manner of another whose acknowledged success in that direction leads us to believe that his is the correct method, and forget that his personality is of an entirely different kind than ours.

In other words, Jack Brown's ways are his individual ways and however good they may be for him they do not fit you and me. When we attempt to adopt his manner and his methods we are spotted immediately and classed as unnatural and lacking in originality. However, there are fundamental rules—many of which have been brought to the front in these "Round Table Discussions"—that should be our rules of faith and practice. Every man should study them and in his own individual way—faulty as it may be—do his best to carry them out.

—JOHN MARK MAY.

Making Good Workmen Out of Poor Prospects

IT IS evident that Al does not have a very clear conception of a foreman's duties. Competition demands an ever reducing cost of production and it is the major part of a foreman's duties to keep costs down and production up. If Al wants to be a good fellow at someones else's expense he should apply for a job with some benevolent society. Labor is a commodity to be purchased as cheaply as possible. Al was entrusted to buy this commodity, therefore be violated that trust when he admitted paying more than was necessary.

Half the wildcat stock that is sold today is being sold by so-called good personality and if I was hiring a salesman that is what I would look for. A good personality means also a good talker and I do not see just where he fits into a machine shop. Personal appearance is an asset but I fail to see why it should be given any consideration in a machine shop.

In regard to developing men, it is still impossible to fit the proverbial square plug in to a round hole so why should a busy foreman waste his time developing men more suited for other vocations. If the supply is good, pick out the man who is already developed but do not waste time on him. A foreman is paid for production not for developing men.

—FRED PATTERSON.

Getting Men to Observe Safety Rules

SINCE every foreman feels morally responsible for the accidents in his department it is to a great extent his duty and privilege to establish safety rules ahead of orders from the outside. It is every man's duty and right to be a part of the establishment in which he works by suggesting measures tending to make for safer conditions in his department. Every man has the right to use the expressions, "Look out there, Dopie," "Better put the goggles on, Simp," "Set that rest up a little closer to the wheel, Sap," "Take off that loose jumper before you put on that belt, Mutt!" and a thousand others during a week's run. The Safety Council can follow up and paste up pictured and worded warnings, but it is the foreman's business to see that they are observed and maintained. The insurance company settles in cash for loss of sight, limbs or life, but the injured person pays in blood and pain, and perhaps in the loss of valuable members of his body that cannot be replaced. HE PAYS. In order to build up a tradition of safety to eliminate as much as possible the accident hazard, the builders of the tradition must be men of experience. It is not the open or visible places that are the real hazards. By studying the character of the accidents it will be seen that a large number of them happen in seemingly most impossible ways.

It all comes back to that one word so often spoken but seldom observed—co-operation. That will build safer shop conditions.

—STORRS T. RICHMOND, *Master Mechanic.*

Getting Men to Observe Safety Rules

THE foreman is responsible for the conduct and methods used by the men in his department. He is, therefore, responsible for accidents that occur on jobs under his supervision. It is up to him to see that his machines and tools are equipped with efficient safety guards and to instruct his men in the necessity of having these guards kept in good order. They should be told that the safety of other men depends upon the manner in which they themselves obey the safety rules adopted by the company.

Accidents may be prevented, in the case of the grinding machine, as illustrated, by having adjustable guards

THE · NEXT · TOPIC

Who Should Go to the Storeroom?

QUESTIONS

How can the time of high-priced men now used in trips to storerooms and toolrooms be saved?

Is it possible in assembly and machine work to plan far enough ahead to have messengers do the errands while the men go on working?

instead of the fixed guard as shown. As a further precaution the men should wear the goggles supplied to them. Failure to observe the safety rules should be a justifiable reason for dispensing with the services of negligent workmen. Where guards are needed on tools they should be issued from the store room along with the tools to be used for the job.

—C. L. HENRY, *England.*

Should Foremen Be Good Actors?

SARCASM or joking should not be indulged in by the foreman who wants to retain the respect of his men. If any change of style be indulged in let it be of an educational character such as will tend to help and interest the men in their respective trades, a little fatherly advice to the apprentice and suggestions to the older men.

It is not wise to frequently change style and to act differently at different times. Men are quick to recognize the acting and sometimes will misunderstand the motives for it. If a foreman maintains one regular attitude, a friendly, helpful, cheerful and sympathetic manner, he will command the respect of his men.

—H. MAPLETHORPE, *England.*

Should Foremen Be Good Actors?

IT MAY be impossible for Ed to act in a meeker way because of bad habits but he should be able to see that better results can be obtained by his being more tactful, considerate and kind. He would then arouse the attention, the interest, curiosity and sense of humor of his men who would instinctively respond to his "gentlemanly manners," learn to like him, and, therefore, please him by doing better and more work.

The man who is going to get the best results from his men is the quiet foreman who knows his business and who is not ashamed to smile occasionally, who helps his men by clear and brief suggestions rather than meaningless commands, and who is willing to listen quietly rather than talk boisterously. —R. SENAY.

Making Good Workmen Out of Poor Prospects

IN A recent talk, the speaker gave the opinion that the goodwill of the employees was as essential to a successful business as the goodwill of the customers. This seems to be fairly well brought out by Schimmel's attitude after having his pay voluntarily raised by Al.

It does not pay to spend time in trying to develop unpromising men or boys. This procedure might be considered analagous to putting into a machine a gear with one or more teeth broken. How far a foreman can go in giving his men a chance to develop depends more or less on the authority he has. There are none of us that are perfect but let the foreman point out the faults of his workmen. The man he criticizes may be egotistic. If he is, the man will probably be blind to his faults, or indifferent to them. —BENJ. C. THOMAS.

Getting Men to Observe Safety Rules

AS A BOY I worked at a two-wheel grinder. One day the other of the two wheels burst killing a man instantly and giving me a terrible fright. At that time I had very little thought of ever being a foreman but the lesson was never forgotten and hundreds of men and boys have received a warning from me never to put their heads in line with the wheel. As a result, two burst wheels have accounted for only one damaged finger soon mended.

Another avoidable yet common accident comes from men and boys often carelessly standing under crane loads. If it is necessary to work under a suspended load, tressels or blocks should be used. In making this compulsory I am sometimes considered faddy but it has saved one man from being crushed to death. The foreman must prevent any unnecessary risks.

—F. P. TERRY, *Ireland.*

Getting Men to Observe Safety Rules

THE responsibility for safety is up to the management. So long as there are chances to be taken workmen will frequently take them. It does no good to say, "Discharge the workman who does not observe the safety rules," because we are all careless at times. To discharge everyone who breaks a rule would soon leave the shop without workmen to operate it.

Proper safety appliances are the only means of keeping accidents at a minimum. Too often haphazard safety appliances are put on machines simply to pass the requirements of the law, and inefficient state inspectors who receive their appointment through a political pull O.K. them without having the least idea as to the efficiency of the devices. The superintendent should see that the foreman is doing his part and the factory manager should see that the safety appliances are not simply means of bluffing the inspectors.

—C. O. SCHWENDIMAN.

Getting Men to Observe Safety Rules

BOTH the State Compensation Laws and the insurance company's rating make it advantageous to the employer to provide safety devices but if the men are permitted to disregard them they are useless. Many up to date factories have a Safety Board composed of officials and foremen who make regular inspections of the factory periodically and report any machine or condition which they consider unsafe.

The foreman should be held directly responsible for the obedience of the workmen to all safety rules. It is safe to say that most accidents are caused by carelessness. Every factory has certain employees who are good workmen but very careless of their own safety and that of their fellow workmen. They usually ignore the safety devices provided on machines. This type of employee should be warned on the first offense and promptly discharged on the second. There should be no exceptions; no one is immune from accidents.

—WILLIAM E. KELVIE, *Engineer.*

Cutting Down Spoiled Work

ILL feeling between the inspection and machining departments is unfortunately not uncommon. By a coincidence I overheard a conversation between two employees on the day that I read the Ed and Al article, and one of them said: "Yes, and if you upset the inspector you get all your work back again, whether it's wrong or not."

I remember a superintendent who contended that it

was a good thing to have the inspectors and foremen at loggerheads. He said that it made them more keen. As it worked out, much more work was rejected than should have been, work was piled into the inspection department, and then complaints were made that machines were held up for second-operation work. Finally one of the foremen and an inspector came to blows over a difference, resulting in their discharge. The better feeling between the new men resulted in higher production, and the quality was no lower than before.

—A. F. GUYLER, *England.*

More About Discipline in the Shop

OF ALL the ways of showing a man his place, I think the most dangerous is that proposed by Al. There is nothing a skilled man resents more than being put on a rough job, even if he still gets the same pay. The fact remains that he has lost dignity. A man would be a poor specimen if he did not resent such action of the foreman.

Then again there is the youngster to be considered. Would the man be inclined to treat him fairly in the future? Probably the boy would feel uncomfortable during the day, as he would have a good idea of the reason for his promotion. After the experiment the boy would have to resume his filing, and he would not be pleased over that. —A. L. WALKER, *England.*

Which Kind of Man Is More Valuable?

I AM in favor of the man who informs his superior of any defects when a casting or any piece of machinery does not come up to standard. Supposing, for instance, that the "nosy man" is detailed to do a special casting in a railway shop. Before completion he discerns a flaw, and thinks it too trivial to report. When everything is all set and in good working order, an explosion may occur due to this defect causing loss of life. Therefore, let me say that the man who reports small things, and feels dissatisfied if work is not to perfection, is taking no chances and taking for his motto "safety first." —JOSEPH BUNGAY, *Canada.*

More About Discipline in the Shop

AL SEEMS to get some good dramas in his shop, but I am afraid that if he were to give some actors the parts, his company would soon go to smash. Not every man is willing to stand by and see a youngster put on his job, without having a few words to say on the matter. To begin with, does Al know for sure that Bill's sight was as good yesterday as it might have been? Welding, at best, is a terrible strain on the eyes.

A skilled man is naturally jealous of his knowledge, and once impositions of this character are inflicted on him, his lips will be sealed when it comes to giving the apprentice the benefit of his past experience.

—NEWTON E. GEOFFRY, *England.*

Cutting Down Spoiled Work

SOMETIMES, through speeding up production, there is an increased percentage of scrap. This does not mean that the ultimate cost per piece is greater than before. When all things such as running costs, price of material, and wages are considered, it may be found that the increased scrap is more than balanced by the saving effected by increasing the output.

Ed would be ill-advised to put the men's names on work that they scrap. No scrap is deliberately made, and the chances are that to avoid having scrap with their name attached the men would become too careful and output would suffer. —JAMES C. HARPER, *Scotland.*

More About Discipline in the Shop

I HAVE experimented with Al's idea of temporarily demoting the careless workman on several occasions, and at no time with anything approaching success. Nor would the success of the experiment reflect any credit on the foreman concerned. In fact it casts a reflection on the mentality of the worker who allows the foreman to treat him in this way.

The policy of "get on or get out" seems to be what the skilled men in this country prefer, as a man of any caliber takes a pride in showing his skill and will not do botched work. Another point is that if the experiment is repeated there will soon be a reluctance to teach anyone the tricks of the trade.

—S. A. BURBEY, *England.*

Which Kind of Man is More Valuable?

THE man who can always be depended upon to do things right, and to report things that are wrong is a valuable man, and in these days of piece work and bonuses it makes little difference whether he is fast or slow.

Of course he is frequently the man who goes to extremes in running to the foreman with every little thing, many of them inconsequental and possible of decision by the man himself, but even such a so-called nuisance is more desirable than the man who works without knowing or caring what he is doing. —WM. C. LANDIS.

Making Good Workmen Out of Poor Prospects

RAISING Schimmel's pay was the least important thing that Al did when he made the change in wages. Schimmel profited a few dollars and was put on the road to better things, if those things were in him. His labor was worth the increased pay and the fact of its coming to him unsolicited increased the return per dollar paid him. The other workers will be made to feel that if "Schim," with all his sour looks, could get over with the boss by doing his work well, there would be a chance for them. The development of men like Schimmel always pays. Any man who will show by his work that he appreciates what has been done for him, may go a long way.

A poor personality is a handicap to an unskilled man, to the skilled man it is sometimes an asset. The standing of the skilled man is rated almost entirely by the results of his work, the accuracy, the finish, or the quantity. The man of poor or no personality may hold his job the longest because he becomes one of the efficient parts of the shop, requiring no attention from those over him. Al saw that Schimmel's work was good enough to pay better on a better job. The company will get better returns and Al will have a good, faithful man.

—H. L. BROWNE.

Ideas from Practical Men

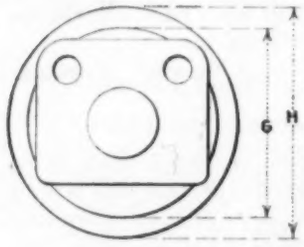
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Series of Pillar Press Tools

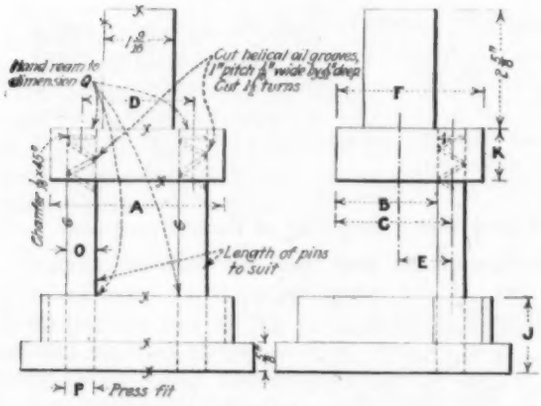
BY D. A. ROGERS

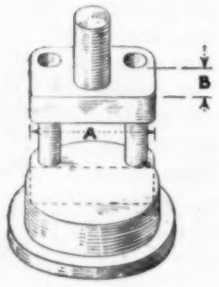
The dimensions of all the parts for a series of pillar press tools covering five more generally used sizes, are given in the table accompanying the layout illustrated.

Since the table of dimensions given for the various sizes has been in satisfactory use in several local die shops for some time, I believe the data will be found to be practical and useful by a number of shops which may have occasion to use these tools. The letters in the data table correspond to the dimensions given in the drawings. The data also include the tolerances that may be allowed on the pillars of these tools.



Size A×B	C	D	E	F	G	H	J	K	O	P	Q
3½ × 2½	2⅞	2¼	1⅜	3⅜	4	5	1¾	1¼	0.624 +.00000 −.0002	0.6265 +.00000 −.0002	0.625
4½ × 2⅞	2⅛	2⅞	1⅞	3½	5	6	1¾	1¼	0.624 +.00000 −.0002	0.6265 +.00000 −.0002	0.625
5½ × 2⅞	3⅛	3½	1⅞	4⅜	6	7	1¾	1¼	0.999 +.00000 −.0002	1.002 +.00000 −.0005	1.000
7¼ × 3½	4½	4½	2⅜	5½	8	9	2¼	1¼	0.999 +.00000 −.0002	1.002 +.00000 −.0005	1.000
9 × 4⅜	5⅜	6	3½	6⅞	10	11	2¼	1¼	0.999 +.00000 −.0002	1.002 +.00000 −.0005	1.000
10⅝ × 5½	6	7	4½	7¹³⁄₁₆	12	13	2½	1¼	0.999 +.00000 −.0002	1.002 +.00000 −.0005	1.000





Diagrams and sizes for a series of pillar press tools

A Mandrel for Form Tools

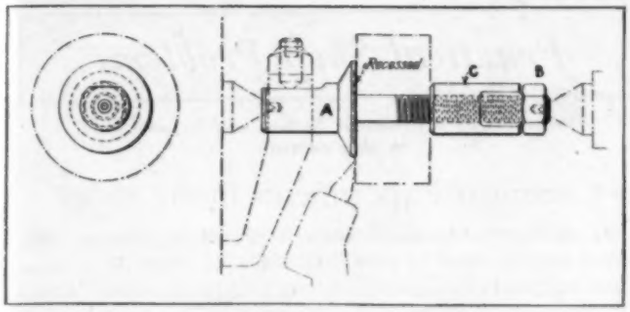
BY HENRY SIMON

A mandrel for turning and grinding the form-tools used on screw machines, which has been thoroughly tried out and found to do good work, is shown in the illustration.

One important point in a mandrel of this kind is that it should be so proportioned as to allow the toolmaker to work at the various corners and shoulders of the tool without being obliged to reverse the mandrel or change the cutting tools more often than is necessary. On the other hand, he should be able to drive the mandrel from either end, as sometimes a tool cannot be finished otherwise. Another point is that the mandrel should be capable of holding the work true after it has been ground.

The mandrel illustrated satisfies these requirements and permits rapid handling of the work. It consists of a one-piece body *A* made with a flange and a driving end provided with a flat for the lathe dog, while the mandrel proper is in the form of a stud of a size about 0.001 to 0.002 in. smaller than that of the nearest reamer that will clean the hole in the form-tool blank. The central portion of this part is plain, the end being threaded to receive the nut *B*, which acts upon the blank through a collar *C* of the same diameter as the driving end, and also formed with a flat to allow it to be used for driving. The flange is ⅛ in. smaller than the smallest diameter of the tool the mandrel will hold, and is recessed on its inner face so as to bear only with its peripheral portion. All parts should be hardened and the registering surfaces of the flange and stem ground true with each other. Collar *C* should also be ground parallel on the ends, and both faces of nut *B* made square with the thread, which can be done by screwing it lightly in place on the mandrel so that it will just protrude over the end and grinding the exposed face, repeating this process several times on alternate sides.

A mandrel so made has no tendency to throw the work out of true unless the blank is "out" to a considerable extent. Because of the play between the hole in the blank and the mandrel stem, ordinary deviations of the hole from a right angle to the surface of the blank have no effect, and distortion of the mandrel results only when a blank is used in which the faces are out of parallel to each other. Usually this will make no difference, though occasionally it will be necessary to surface grind the faces of the blank so as to make them parallel. The ordinary run of blanks will come flat against the registering face of the flange, both before and after hardening. Where, as sometimes happens, the hole in the tool has shrunk during hardening,



A mandrel for form tools

it can be restored to its proper size by a few passes on a lap.

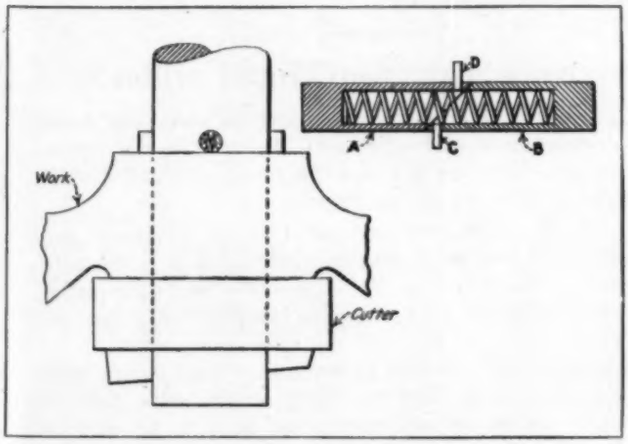
It is best to use a lathe dog changed as indicated in the illustration in order to have additional space for working on the corner of the blank near the live spindle. This dog is slightly bent and the ordinary screw is replaced by a headless setscrew. Its use permits negative clearances, such as are often required at one or the other faces of the tool, to be conveniently formed with ordinary cutting tools and without reversing the mandrel. It also gives ample space for admitting a grinding wheel.

Plunger Gage for a Back Counterbore

By Harry Moore
Montreal, Canada

The plunger device illustrated is efficient for counterbore bars designed to work upwards, as when an inside face is being finished to a definite thickness from an outside face previously finished. It takes the form of two plungers which spring out instantly when the counterboring has reached the required thickness.

Two holes are drilled through the bar at right angles to each other. Two plungers *A* and *B* are made to fit one of these holes, the plungers being equal in length,



Gage for a back counterbore

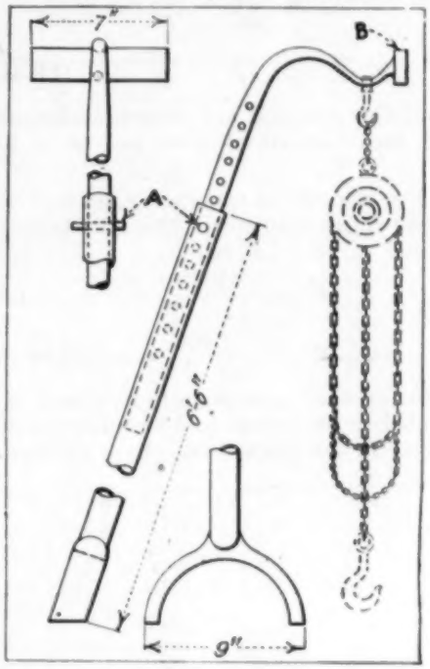
drilled to receive a light spring, and cut off at one end diagonally. At these ends small holes are drilled to receive the stop pins *C* and *D*. To assemble the parts in the bar, the spring is placed inside the plungers, the two blades are pressed together and the stop pins are driven in.

In operation, the plungers are pressed in with the fingers to allow the bar to pass through the hole, the cutter is then inserted and the bar is fed upward.

Rig for Assembling Locomotive Springs

By Frank Waldo

The illustration shows a handy rig for assembling springs and other heavy parts to locomotives. It consists of two pieces of pipe telescoped one within the other, the adment for height being locked by the pin *A* fitting into holes in both members. The lower end of the larger pipe is provided with a forged leg having a spread of 9 in., for stability. To the upper end of the smaller pipe is welded a rod on the outer end of which is the pad *B* to bear against the running board of the locomotive. The part behind the pad is bent into a goose neck to hold the hook of a chain block or tackle. The device saves a lot of the time usually required to fit springs in place when the block must be suspended from overhead timbers.



Adjustable rig for assembling locomotive units

Method of Finding the Radius of a Segment of a Disk

By Leo Laubmeyer

The following method is useful for checking the radius of a gage or for finding the diameter of a disk when only a fragment of either is available. The method can also be used to check the radius of gear segments and the like.

First, place the sector to be gaged tangent to a surface plate as indicated in the illustration. Two rolls or wires of exactly the same diameter are then placed in contact with the work and the surface plate, and the micrometer reading *G* is taken over them. Then *R*, the radius sought, is equal to $\frac{E^2}{4r}$, where

r = radius of roll or wire

and $E = \frac{G}{2} - r = \frac{G - 2r}{2}$

Proof: Connect center of roll *C* with center of disk *O*, and draw *OB* perpendicular to the tangent plane *HH*, and *CA* parallel to it. Then *OAC* is a right-angled triangle, and

$$\overline{OC}^2 = \overline{OA}^2 + \overline{AC}^2$$

Since $OC = R + r$

$OA = R - AB = R - r$

and $AC = E$

Then $(R + r)^2 = (R - r)^2 + E^2$

or $R^2 + 2Rr + r^2 = R^2 - 2Rr + r^2 + E^2$

Cancelling equal terms on both sides of the equation and combining like terms, we have

$$4Rr = E^2$$

$$\text{or} \quad R = \frac{E^2}{4r} \qquad \text{Q.E.D.}$$

If the two rolls are chosen with a diameter of 0.500 in., then r equals 0.250 in., and $4r$, $= 1$, whence

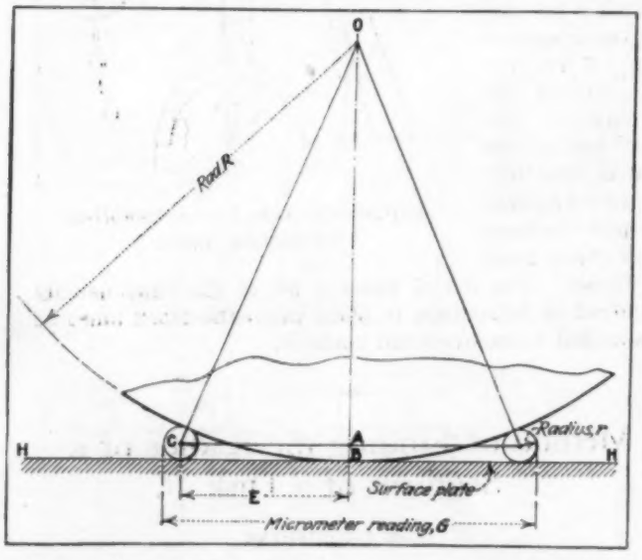
$$R = E^2$$

For example, a spherical gage was checked with rolls 0.300 in. in diameter. The micrometer reading G was found to be 3.300 in.

$$E = \frac{3.300 - 0.300}{2} = 1.500 \text{ in.}$$

$$R = \frac{1.500^2}{r \times 0.150} = 3.750 \text{ in.}$$

As another example, a broken part of a gear was presented to the writer to determine the diameter, number of teeth, and pitch. The above method was used.



Two rolls 0.500 in. in diameter were used, and the micrometer reading G was found to be 7.1832 in.

Then $E = \frac{G}{2} - r = \frac{7.1832}{2} - 0.250 = 3.3416$ in.

$R = E^2 \quad = 3.3416^2 \quad = 11.1666$ in.

The outside diameter of the gear wheel equals $11.1666 \times 2 = 22.3333$ in.

To ascertain the number of teeth the whole gear wheel would have, two points on the disk were chosen at random and the peripheral distance between them was measured with a flexible scale or a tape line. The number of teeth between these two chosen points was found to be 33. The distance was 17.543 in. The circumference was $22.3333 \times 3.1416 = 70.172$ in.

and $\frac{70.172}{17.543} = 4.$

Therefore, the number of teeth in the whole gear must be $33 \times 4 = 132$ teeth.

$$\text{Pitch, } P = \frac{134}{22.333} = 6.$$

$$\text{Pitch diameter, } D = \frac{132}{6} = 22 \text{ in.}$$

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Chemical Experiments in the Shop

Q. Will you advise whether there are any bluing salts which can be used in combination with cyanide so that when the parts are cyanided they will have a blue finish? We are making parts of S.A.E. 3135 chrome nickel steel, and we wish to do the heat-treating in a cyanide pot and try to get a blue finish at the same time.

A. We do not know of anything that can be put into the cyanide bath to complete the bluing operation when the parts are cyanided. Any of the ordinary bluing agents will react with the cyanide and cause trouble.

As far as we know there has not been any information published on the matter due to the lack of demand for it. It is usually customary to clean and polish the parts after heat treating, before they are blued, and we believe that the two separate operations will give better results.

But if you desire to experiment, it is more likely that results will come from putting the bluing agent into the cooling bath rather than into the heating bath. For example, nitrate of copper, or a mixture of nitrate of copper and nitrate of manganese, might give results in the cooling bath, but would give a very poisonous reaction if put into the cyanide.

However, we would accent the point that as a general principle it is never advisable to permit a workman to experiment with chemicals in the shop unless he is thoroughly familiar with the principles of chemistry. Experiments of this kind should be performed under laboratory conditions, as it is very easy to make explosive or poisonous compounds. The fumes of cyanide and nitrous compounds are especially dangerous to the lungs of the workmen.

Removing Scale from High Carbon Steel

Q. What is a good pickle to use in removing heavy scale from high-carbon steel? We now use a hydrochloric acid solution hot, but the fumes are undesirable, and the results are not uniform.

A. A 10 to 20 per cent solution of sulphuric acid should give you good results when used at a temperature of about 175 deg. F. A solution of "niter cake," which is sodium acid sulphate, is also used for this purpose.

All acid solutions will produce injurious fumes when acting on metals, and for that reason some kind of exhaust system should always be used to protect the workmen. A simple ventilator can be easily rigged up over the pickling tanks.

Soldering Flux

Q. Can you give me a formula for a non-acid soldering flux?

A. A good flux that is used in electrical work where an acid flux is objectionable is a simple solution of rosin in alcohol. Take a pint of industrial or other alcohol and dissolve into it about a quarter of a pound of rosin.

Weights of Circular Castings

(Continued)

Diam.	Weight in Pounds per Inch of Length				
	Cast Iron	Wrought Iron and Steel	Common Yellow Brass	Bronze	Aluminum
29	172	186	199	211	61
29½	177	192	206	219	63
30	183	199	213	226	65
30½	190	205	221	234	67
31	196	212	227	241	69
31½	202	218	235	249	71
32	209	226	243	257	74
32½	216	231	251	266	77
33	222	240	257	273	79
33½	229	247	265	282	81
34	236	255	274	290	84
34½	243	263	282	299	86
35	250	270	290	307	89
35½	257	278	299	317	91
36	264	286	307	325	94
36½	272	294	315	335	96
37	279	302	324	344	99
37½	287	310	333	354	102
38	295	319	342	363	105
38½	303	328	352	373	108
39	311	336	361	382	111
39½	319	345	370	393	113
40	327	354	380	403	116
40½	335	362	389	412	119
41	343	371	398	422	122
41½	351	380	408	433	125
42	360	389	418	443	128
42½	386	398	428	453	131
43	377	408	437	464	134
43½	386	418	448	475	137
44	396	428	460	487	141
44½	405	438	470	498	144
45	414	448	481	510	147
45½	423	458	491	521	150
46	433	468	503	533	154
46½	442	477	513	544	157
47	451	488	523	555	160
47½	461	498	535	567	164
48	471	509	546	579	167
48½	481	520	558	592	171
49	491	531	570	604	174
49½	501	541	582	616	178
50	511	552	593	628	182
50½	521	563	605	641	185
51	531	574	616	654	189
51½	543	587	630	668	193
52	554	599	643	682	197
52½	564	610	655	694	201
53	574	620	666	707	204
53½	585	632	679	720	208
54	596	644	692	733	212
54½	607	656	705	747	216
55	617	667	716	760	219
55½	630	681	732	775	224
56	641	693	744	788	228
56½	652	705	756	803	233
57	664	717	770	817	236
57½	676	730	785	832	241
58	688	743	798	847	245
58½	700	757	812	862	249
59	712	768	825	876	253
59½	723	782	838	890	257
60	735	795	853	905	261
60½	748	808	869	920	266

Diam.	Weight in Pounds per Inch of Length				
	Cast Iron	Wrought Iron and Steel	Common Yellow Brass	Bronze	Aluminum
61	760	822	882	935	270
61½	773	836	897	952	275
62	785	848	912	967	279
62½	798	863	927	983	284
63	810	875	940	997	288
63½	823	891	955	1,013	293
64	836	904	970	1,028	298
64½	850	919	987	1,046	303
65	863	934	1,000	1,062	307
65½	877	949	1,017	1,078	312
66	890	963	1,033	1,095	317
66½	903	977	1,047	1,111	322
67	917	992	1,064	1,128	327
67½	932	1,007	1,080	1,146	332
68	944	1,020	1,095	1,162	336
68½	958	1,036	1,111	1,179	341
69	972	1,050	1,127	1,196	346
69½	986	1,065	1,144	1,213	351
70	1,000	1,080	1,160	1,230	356
70½	1,014	1,097	1,177	1,247	362
71	1,030	1,114	1,195	1,267	367
71½	1,044	1,130	1,213	1,285	372
72	1,058	1,144	1,228	1,302	377
72½	1,074	1,162	1,247	1,322	382
73	1,088	1,177	1,262	1,340	387
73½	1,102	1,191	1,276	1,354	392
74	1,117	1,207	1,296	1,375	398
74½	1,132	1,224	1,313	1,392	403
75	1,150	1,243	1,334	1,415	410
75½	1,165	1,260	1,351	1,433	415
76	1,181	1,277	1,370	1,452	420
76½	1,195	1,293	1,386	1,470	425
77	1,210	1,308	1,404	1,490	431
77½	1,226	1,325	1,423	1,508	436
78	1,243	1,345	1,442	1,530	442
78½	1,258	1,360	1,460	1,548	448
79	1,274	1,377	1,477	1,567	454
79½	1,290	1,395	1,496	1,587	459
80	1,307	1,413	1,516	1,608	466
80½	1,323	1,430	1,536	1,627	471
81	1,340	1,448	1,555	1,648	477
81½	1,356	1,465	1,572	1,667	483
82	1,372	1,483	1,590	1,689	488
82½	1,389	1,500	1,610	1,709	494
83	1,406	1,520	1,630	1,730	500
83½	1,422	1,537	1,650	1,750	506
84	1,440	1,557	1,670	1,770	512
84½	1,458	1,576	1,690	1,792	519
85	1,475	1,595	1,710	1,815	525
86	1,510	1,633	1,750	1,858	537
87	1,545	1,670	1,790	1,900	550
88	1,581	1,710	1,835	1,945	562
89	1,616	1,745	1,874	1,987	575
90	1,652	1,783	1,915	2,003	588
91	1,691	1,825	1,960	2,080	602
92	1,730	1,870	2,008	2,130	616
93	1,766	1,905	2,049	2,170	628
94	1,805	1,950	2,092	2,220	642
95	1,842	1,968	2,135	2,265	655
96	1,882	2,030	2,180	2,310	669
97	1,920	2,070	2,228	2,360	684
98	1,960	2,115	2,273	2,410	697
99	2,000	2,160	2,320	2,460	712
100	2,040	2,202	2,367	2,510	726

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Technical Abstracts

Need We Fear a Job Famine?

The American workman is making three automobile tires where ten years ago he made one. All the way from shoes to automobiles, the American workman is turning out more things than ever. He is doing it partly through his own increased efficiency, his willingness to adopt new methods, and partly through the use of many different kinds of machinery. One tire concern in 1920 employed 2,200 men. The output of the plant was 2,200 tires a day. Today the same plant employs about 800 men and produces 2,000 tires. Increased production was due probably less than 20 per cent to the increased efficiency of the workman, 60 per cent to management and routing of material inside the plant, and 20 per cent to changes in machinery and processes.

The universal employment of machines to do the material handling and processing of heavy work, and in many cases the finer work that formerly was done by men is reducing to such an extent the time required to produce the world's needs that Secretary Davis is one who is a bit concerned about the future. He points out that a machine does not eat food, does not require clothing and does not rear a family. The textile mills in this country can produce all the cloth needed in six months' operation each year. Similarly, 14 per cent of the boot and shoe factories in the United States with their modern machinery could produce all the footwear needed if they operated full time and 3 per cent of the present flour mills could produce all the flour needed. We should have some system for scattering unneeded workers in any industry, where they are really needed in industries yet to be developed.

Ethelbert Stewart, chief of the Bureau of Labor Statistics, has declared that what is being done on the farms to relieve men from heavy labor, to make possible greater production with shorter hours, thereby giving more time for recreation, and the gratification of new living desires, is being done in an even greater degree in the cities. If increased production continues in the future as it has in the past, he believes that Henry Ford's five-day week of 40 hours of labor is but a "starter." It may be that the world's needs ultimately will be produced by three days' work a week.—James L. Wright, *Nation's Business*, Jan., 1927.

How Accidents Happen

In order to impress the workmen and executives of their plant with the number of accidents that are entirely preventable, Alfred Herbert Ltd., Coventry, England, recently "reconstructed" an accident and had the various stages photographed to show practices that should be avoided.

The accident was caused by a rope sling slipping off a piece of work as it was being lowered to the table of a planer, resulting in a broken leg for the operator. The photographs show how the accident occurred and also an improved method of handling in which the rope sling is held in the opening formed behind the screw of a C-clamp that is fastened to the work. Sir Alfred Herbert quotes from the *American Machinist* as follows:

"The first thing that is obvious about a workshop accident, when it is investigated, is the fact that it was not really an accident at all but a perfectly normal effect of causes that should not have been allowed to operate."—*Machine Tool Review*, Nov.-Dec., 1926.

The English Ford Motor Co.

The British do not feel that the Ford motor is an outsider as nearly 100 per cent of the car is now made of native material and by native workmen. Nor do they agree that Ford methods are not applicable as the management is entirely in the hands of English officials who have become convinced of the efficiency. At the Trafford Park factory 2,100 workers are producing 120 cars of various models, per day.

The relation between sales and production is shown by hourly entries on the production board in the works manager's office. Under normal conditions the engine line, which is the center of the organization, has a capacity of 20 complete engines per hour. This production is varied to suit the output desired.

"Minute cost" is the basis of control for the whole plant. In this way the efficiency is gaged in terms of the number of minutes that would be taken by an average employee in doing the entire job. An engine and transmission gear box assembly for example, takes 230 minutes, this covering the entire cost of the entire assembly. These figures are compiled from the foreman's record in conjunction with the inspection department, being checked off against the wage tickets. The objective aimed at is a minute cost of 200 for this assembly.

Radiator tubes are rolled up from a flat sheet $1\frac{3}{8}$ in. wide and 0.010 in. thick. The finished tube is $18\frac{1}{4}$ in. long of $\frac{3}{4}$ in. diameter, and tinned on the outside. The speed of the strip is 160 ft. per min. for rolling and soldering.

Bearings are run-in by an electric motor for three or four min. and after examination, the engine assembly continues. The camshafts are selected from several standard sizes to give the correct oil film in the bearings. Pistons are also selected so as to secure the proper clearance, and the connecting rod bearings are run in the same as the crankshaft.—*The Automobile Engineer*, Jan., 1927.

Electric Locomotives for the Great Northern

Two motor-generator electric locomotives, recently delivered to the Great Northern, will be used on the western slope of the Cascade mountains where there is an average grade of two per cent.

The locomotives are to be operated from an 11,000-volt, 25-cycle, single-phase trolley. Alternating current will be transformed and converted into direct current by a transformer and motor-generator set on the locomotive, thus minimizing the copper and power losses, permitting unattended transformer stations, light overhead-trolley construction, and a wide range of control.

Each locomotive consists of two motive-power units operating in multiple and connected by a draw bar. The weight of a complete locomotive is 357.5 tons, of which 274.8 tons are on the drivers. Each unit is complete in itself and can be operated independently of the other.

Current is taken from the overhead wire by pantographs. Power is conducted from a bus line through an oil-insulated circuit breaker to an air-blast transformer, where it is transformed to a lower voltage and delivered to the motor of the motor-generator set. A 125-volt, 75-kw., d.c. machine, overhung on the motor bracket, is used for excitation for the various machines, and for power for some of the auxiliaries. The generator bracket carries another d.c. generator for exciting the fields of the traction motors, when regenerating, and when high speed is desired with heavy loads.

Each axle is driven by a single, axle-hung, d.c., series type, traction motor, through a pinion on each end of the armature shaft, meshing with a flexible gear on the hub of each driving wheel. A 125-volt, 238-ampere-hour storage battery supplies power for starting the main motor-generator set and, during interruptions of the trolley circuit, for running the compressor, and for control and lights.

Each locomotive can haul a 1,000-ton trailing load on a two-per cent grade at a speed of 19.8 m.p.h. By using a second locomotive as a pusher, a 2,800-ton load can be moved at 15.4 m.p.h. on the same grade.—*Railway Age*, Jan. 29, 1927.

Test on a Welded Tank Head

A welded ethylene tank head, 60 in. in diam., was tested to destruction to determine whether any changes had been made in the physical properties of the head by the various processes, such as welding and forging, to which the head had been subjected.

The path of rupture did not follow any welding seam. Sections of the head were cut out and tested in tension.

Macro and micro photographs were also taken and chemical analyses made. The conclusions reached were as follows: The weld metal (nickel steel) showed ample strength, and the base metal next to the weld was not injured by the heat of welding. The welds were of the double-V type of good quality and the fusion and penetration were satisfactory from a production standpoint. There was no evidence to indicate that the 1,000-lb. test pressure had affected the weld in any way. It was also found that the physical properties of the metal in different parts of the head remained unchanged.—S. W. Miller, *Mechanical Engineering*, February, 1927.

Aviation Progress in 1926

While few spectacular accomplishments, except the Byrd polar flight, marked the year 1926, progress was most significant in the breaking down of barriers and in educating the people generally in what is called "airmindedness"—a realization and appreciation of the part to be played by air craft in the days to come. The Morrow Air Board, the improvement in army and navy air corps, the appointment of "air secretaries," for army, navy and commerce, were all important.

Few appreciate the amount of civilian flying done in the United States—the total mileage reaching to over 9,000,000 in 1925 and being even higher in 1926. This is at least twice the mileage flown in all Europe. The Air Mail, and the new contract lines authorized by the Kelly Bill, add much to our non-military aviation. The average air-mail efficiency of over 97 per cent did much to secure the air contract of the American Express Co. which marked a beginning of much more extensive air delivery of important packages all over the country.

The Ford Reliability Tour proved that modern commercial planes, even those of small size and low cost, were dependable for cross-country work in all kinds of weather. The new contract mail routes are also making a good showing. Air-cooled engines are coming to the front for aviation, although for racing planes where very high power must be coupled with small head resistance, the water-cooled engine still holds its place. The prospects for 1927 are equally bright and further advances are expected.—W. L. LePage, *Aviation*, Jan. 3, 1927.

Metal Planes and Air-Cooled Engines

The Tenth Annual Aeronautic Exposition in Paris in December, 1926, ran for three weeks and was dominated by the military element. There were 173 exhibitors. The tendency toward the use of more metal in construction was marked even though only a few could be called all-metal. One of these was the Avimeta, by Schneider, a two-seat scout monoplane in which no fabric is used. The entire plane is made of a metal called Alferium. Another plane of the same type was the Bernard 12 C2.

A new passenger plane to carry 18 passengers in a central fuselage was shown by Liore & Oliver. Two Jupiter, air cooled 420-hp. engines are used. This is an all metal plane with fabric cover. Breguet's new commercial plane is of steel and duralumin, except for the covering of the wings and the passengers' cabin. The latter is 3-ply wood and the former fabric. A fireproof partition separates the engine from the pilot house. The engine is a 420-hp. Jupiter but either a Lorraine-Dietrich or a Hispano 450-hp. can be used interchangeably. Other interesting planes were the Farman 8-passenger wood and metal monoplane, a Fiat all metal, fabric covered scout biplane and others.

The engine division showed increased activity in air-cooling, in reducing gears and a tendency toward larger units. The largest single unit was a water cooled Lorraine-Dietrich with 12 cylinders of 6.88 x 8.85, a total of 3,958 cu.in. Among the air-cooled engines were the new Lorraine-Dietrich, Jupiter and Salmson.—W. F. Bradley, *Automotive Industries*, Dec. 30, 1926.

Preventing Accidents from Falls

The data now available indicate the extreme seriousness of unsafe walkways, stairs, and ladders. The number of fatalities resulting from them is greater than from all fires, surface cars, and industrial machinery combined. Approximately one fifth of all accidents result from falls, and half of these are caused by unsafe walkway surfaces.

The cost of slipping accidents in this country is conservatively estimated at $100,000,000 a year. These accidents would not occur if hazards were not created nor permitted to exist. Unlike mechanical hazards slippery surfaces do not give warning of danger.

About 15 per cent of falls occur on stairs and almost invariably cause severe injury. If a grade between two levels is greater than 20 deg., and less than 50 deg. from horizontal, stairs should be used. For grades over 50 deg. fixed ladders should be employed, and under 20 deg. ramps are best.

Doorways opening directly to stairs should be avoided. Landings should be large enough to provide standing room outside of the space covered by the swing of the doors, and glass panels in the doors are requisites for safety. Single runs of stairs or ladders should never exceed 8 ft. in the vertical.

Treads on steps should be of sufficient strength to bear the maximum number of people that can stand on them. Width of tread and height of rise must be constant for each run of steps. Treads should be wide enough to allow ample space to place the full length of foot, and a nosing overhang of ¾ to 1¼ in. should be made to prevent striking the heel in descending.

Ramps should have high surface frictional resistance. When a granolithic surface is employed, an abrasive should be floated into it before it takes its initial set. Ramps should never be placed at the head of a run of steps.

Such materials as tile, mosaic, or marble should never be used for exterior sidewalks nor in corridors where persons with wet and muddy shoes must cross them. In sidewalks manhole covers are a most prolific source of casualties. These accidents are from tripping or slipping more than falling into the exposed hole.—H. Weaver Mowery, *National Safety News*, February, 1927.

Design of Pressure Vessels

Tests made on a pressure tank 5 ft. in diam. by 40 ft. long indicate that the common formulas used for designing shells of pressure vessels yield stresses in close agreement with measured stresses in the shell. The influence of secondary stresses is of minor importance, as these irregularities are usually completely ironed out by the high internal pressure.

The tests indicated that very high bending stresses are imposed at the head knuckles, particularly on the inside where the maximum tensile strains occur. It, therefore, seems desirable to increase the corner radius or to redesign the head in closer conformity to the shape it tends to assume under high internal pressure. The highest strain in the tank occurred around the manhole, where head failure first occurred in the vessel.

In some cases the stresses at this point are excessive even at operating pressures. Such stress concentration around holes or points of discontinuity should be taken into account in the design of these pressure heads in the future. In other respects the present designs of pressure vessels are entirely satisfactory, and it has been proved that welding can be safely used for fabrication—T. W. Greene, *Mechanical Engineering*, February, 1927.

Selling Through Retailers and Branch Stores

Experience in selling burglarproof and fireproof safes has shown the Diebold Safe & Lock Co. that the former line requires engineering specialists while the latter can be handled through branch offices and dealers. The salesman seldom goes more than thirty miles from his headquarters. Much difficulty has been met in securing good men. At present men are taken from college or shortly after graduation and put through a course that includes a year in the factory in production, sales and advertising work. They then go to branch offices.

Where dealers are used they are given a definite territory and required to work it extensively. Definite prices and policies have been adopted for the fireproof line but this method has not been possible with the burglarproof line because of the varying engineering features involved in each order. Quotas are set for dealers and as much promotional data as possible is provided for them. Salesmen are brought into the factory periodically to get better acquainted with the product and draw inspiration from head office contacts occasionally.

Experience has shown that it is better to keep a local man in the territory from which he came than to assign a man to a strange locality.—H. A. Noble, *The Management Review*, February, 1927.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Industry's Stake in Education

WHY should industry take an interest in engineering education? Why not leave that job to the college professors and the trustees of the universities and technical schools?

In the first place, engineering education of the right sort teaches young men to think and trains them to recognize the relative importance of traditional methods and new ideas. Industry needs men of this type—there can never be too many of them. If the educational facilities and methods now available are not achieving this end it is very much to industry's interest to see that facilities are provided and methods improved.

It is not the intention here to plead the cause of any particular type of engineering education—each has its field and turns out graduates that meet certain needs. One school tends to develop research men and technical experts, another heads its men toward administrative jobs, a third trains the type of man who becomes an excellent operating executive.

The searching investigation into engineering education conducted by the Wickenden Committee under the auspices of the Society for the Promotion of Engineering Education has proved that this form of training is at least as efficient as that available for any other profession, and better than the average. It has found certain weak spots that need correction and its next task is the ascertaining of ways and means. Unfortunately the funds made available for the original studies are exhausted and new resources must be tapped. Industry has a real stake in the completion of the task and should see to it that the relatively small amount required is forthcoming.

Sport in Industry

THE more nearly work can be made to approach to sport or recreation the more interesting it becomes and the more productive become those engaged in it. Speaking before a small gathering of engineers recently, L. F. Loree, president of the Delaware & Hudson Company, told of the annual contests between crews from the various repair shops of that company. Each year some common stripping, assembling or repair job is chosen and picked crews are entered by each shop in a contest to determine the shortest time in which the job can be done. Much interest is taken in it by the men. One of the interesting results of the contests is that the average shop time for the job that was used for the second annual contest is now equal to that made by the winning crew at that time.

Why would it not be desirable to broaden such a contest by staging one that could be entered by crews from all the railroads in a given district? Such an affair might be staged at one of the big railroad conventions and would add a lot of interest.

A Good Production Slogan

CONVEYOR theory may perhaps be summed up in what is supposed to be the Ford slogan—"Keep material three feet above the floor—and moving."

Any material three feet above the floor can be handled without stooping and it can be lifted with much less effort when necessary. Conveyors also keep work from being stacked in piles that are not only in the way but represent idle capital.

Keeping the material moving not only reduces handling time and cost but also tends to speed up production by keeping unfinished material always at hand. Although conditions vary in different industries the points suggested by the slogan can be applied to advantage in almost any plant. The main thing is to keep it moving.

Parcel Post to Cuba

A LITTLE smoke frequently obscures our vision of larger issues. The Cuban Parcels Post Bill, H.R. 8997, is in danger of failure because we are too apt to think of tobacco as the main product to be affected by parcel post laws between the two countries. And the opponents of the bill are harking back to the law of 1866 which placed a minimum limit of 3,000 cigars to be imported. Because of this law we have refused to admit Cuban cigars in small lots by mail in spite of our postal convention.

Ten days count of parcel post from the United States to Cuba at the Jacksonville office showed 1,312 parcels from 432 shippers in 34 states. They represented concerns which produce more than 200 different kinds of product. Many of these items were mechanical, such as parts of machines, and practically all of them involved machinery in their manufacture.

These shipments are possible only because of the tolerance of the Cuban government and the temporary agreement ends on June 30, 1927. Unless the law is amended our mail exchange with Cuba will be reduced to letters, postcards, commercial papers, samples and printed matter. Small shipments of machine parts, accessories and manufactures of many kinds will become a thing of the past.

Shop Equipment News

Porter-McLeod Improved Geared-Head Engine Lathes

THE Porter-McLeod Tool Works, Hatfield, Mass., have redesigned the line of lathes formerly manufactured by the Williard Machine Tool Co., Cincinnati, Ohio. The 13- and 15-in. sizes are now available, and a full range of 16-, 18-, 21- and 24-in. sizes will be ready for the market in the near future.

As may be seen in Fig. 1, the headstock is of box section, internally ribbed, and entirely self-contained. The box forms an oil reservoir in which the gears of the spindle drive are partly immersed at all times. These gears are made of special alloy steel and are hardened. The constant-speed driving pulley is built as a separate unit and is bolted to the headstock. It drives through an internal friction clutch and may be provided with a reverse if desired. Both the clutch and the reverse mechanism are controlled from the apron of the carriage. Twelve spindle speeds, ranging from 15 to 500 r.p.m. are available in the 15-in. size shown.

The quick-change gear box provides for cutting forty different pitches of thread, ranging from 2 to 56 threads per in., and an equal number of feed changes. All gears in this box are made of alloy steel and have an ample factor of safety so that the feed can be changed while the tool is cutting without danger of tooth breakage. All shafts are supported by bearings on both sides of the gears.

The live spindle is of nickel steel, forged and bored from the solid. It runs in phosphor-bronze bearings, adjustable to compensate for wear, and is provided with thrust collars to take up end movement. The spindle nose is threaded only part way from the end, and a shoulder $\frac{1}{8}$ in. larger in diameter than the threaded portion is left to center the chucks and face plates.

The bed is of a box section with shears of V-shape. The tops of the Vs are rounded so that the carriage bears only upon the angles. The bed rests upon two cabinet legs, one of which incloses the driving motor, when the machine is independently driven. It may also be driven by belt from an overhead countershaft, if desired.

An important feature of the improved design may be seen in Fig. 2, which shows the rear of the apron as detached from the carriage. This apron is of the double-wall type, forming a closed receptacle to hold an oil bath for the carriage gears and providing bearing support on both sides of the gears. Oil holes lead from this reservoir to all of the bearings in both walls of the apron. On the outer side of both front and rear walls directly under each bearing, there is a pocket to catch any oil that may work through the bearing, and this surplus oil is returned to the reservoir by "weep-holes" leading at an incline from the bottom of each pocket. A filling cup is provided on the apron for replenishing the oil and maintaining it at the proper depth, and there is a drain plug at the bottom of the reservoir.

The bevel pinions of the feed mechanism are mounted upon a tubular shaft, the bearings of which are oiled from the reservoir. The feed rod is entirely inclosed by the tube,

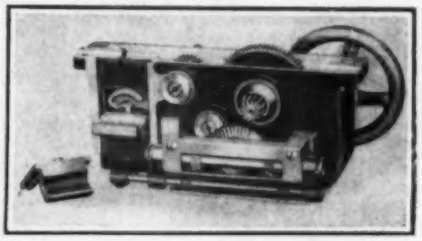


Fig. 2—The apron

which is splined to it, and thus no surplus oil is deposited on the rod as the carriage is moved back and forth. Both the cross and longitudinal feeds are engaged through friction clutches that are reversible in the apron.

The lead screw is made of carbon steel and has an Acme thread. The threading and feeding mechanisms interlock, so that both cannot be engaged at once. A dial, graduated to read to $\frac{1}{8}$ in., is located on the handwheel shaft so that the longitudinal movement of the carriage may be measured directly by it. Micrometer dials, graduated to 0.001 in., are provided for both cross and compound screws. These dials are slip mounted upon their respective screws so that the zero may be brought into a convenient position for reading before starting a cut. A chasing dial set in the wing of the carriage, assists the operator to "pick-up" any thread when using the lathe for thread cutting. The movement of the half-nuts in closing is limited by a stop, so that they cannot be pinched on the lead screw.

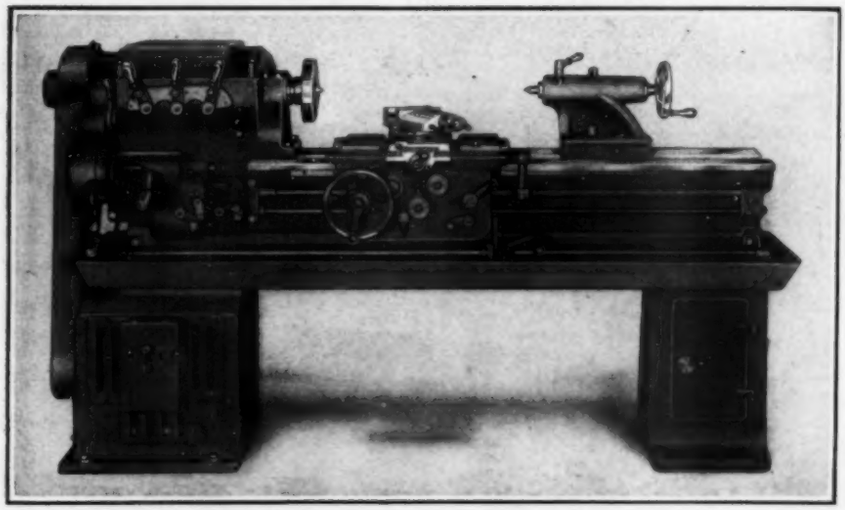
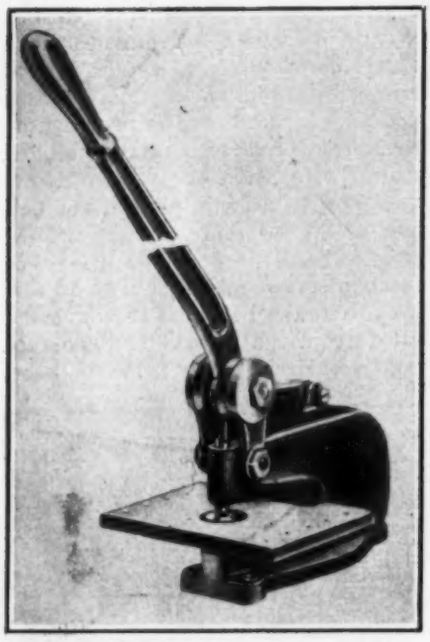


Fig. 1—Porter-McLeod Improved Engine Lathe

Shop Equipment News

Whitney No. 16 Bench Punch

The Whitney Metal Tool Co., Rockford, Ill., is marketing the No. 16 bench punch shown in the accompanying illustration. The machine has a capacity for punching a hole ⅜ in. in diameter through a ½-in. plate. It may be furnished either with or without the work table shown.



Whitney No. 16 Bench Punch

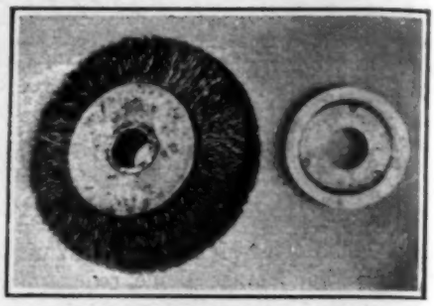
Specialty Manufacturing Co. Circular Brush

The Specialty Manufacturing Co., Berea Road, Cleveland, Ohio, has developed an improved circular brush, for which many advantages are claimed. The brushes are made up in single thickness as shown in the illustration, or these units may be built up in gangs to form wide-faced brushes. These gangs may either be assembled from separate units held in place by the pressure of the shaft end-washers or they may be clinched together as a solid unit.

A pair of strong circular galvanized sheet metal stampings, provided with inwardly turned projections or teeth, hold the brush-material on either side. The tufts of bristle, fibre, wire or other material are accurately weighed to assure each tuft of the brush being equal in balance with the rest. Each tuft is then bent into V-form and inserted between the successive teeth. A few turns of binding wire are then passed completely around the inside of the V, thus drawing the tufts down tightly into position between the stampings in such a manner as to entirely prevent the material from working loose or flying out under centrifugal force. Finally, the stampings are closed down on each other and the teeth, passing through the openings in the opposite stamping, are clinched over, thus compressing the brush material solidly together. The brush is then trimmed to a true circular form.

Among the advantages claimed are the following: In consequence of the accurate weighing and spacing of the tufts, the working surface of the brush is equally dense at all points of the circumference and as a result perfect balance is obtained even at high speeds. When assembled in gangs it is stated that the units will pack together much closer than ordinary brushes because the construction allows a greater weight of brush material to be used. The increased density of the working surface thus obtained is said to be not only conducive to longer wear but it also permits a more even finish.

When it is desired to mount the brush on a polishing spindle of smaller diameter than the stamping a special reducer adapter stamping carrying a smaller hole is fitted into the central opening.

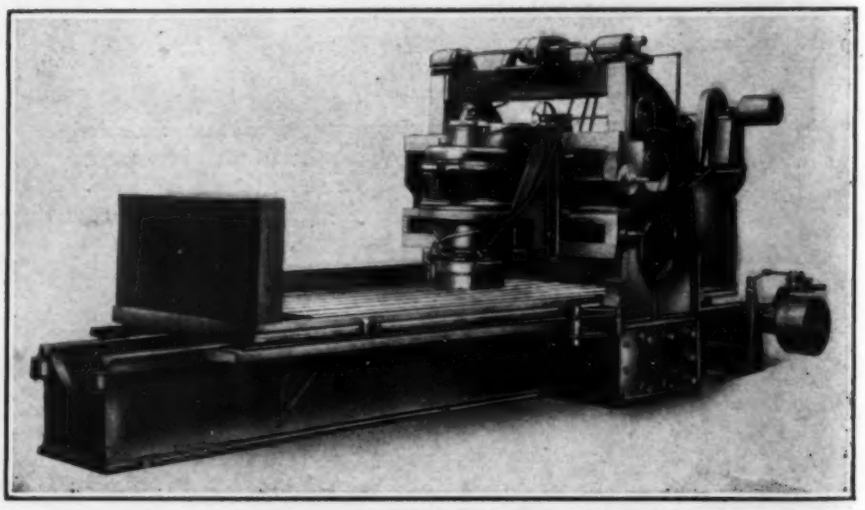


Specialty Manufacturing Co. Circular Brush

Springfield Vertical Surface Grinder

THE vertical surface grinder shown in the accompanying illustration has been built by the Springfield Manufacturing Co., Bridgeport, Conn. It has a capacity for grinding work 10 ft. long, 4 ft. wide and 2 ft. high under the abrasive wheel.

The chief feature of this machine is the wheel head, with a built-in. Westinghouse a.c. motor of 30 hp. The rotor is mounted directly on the grinding wheel spindle, which revolves on heavy-duty ball bearings. A large oil reservoir is provided for each ball bearing, and a revolving splasher insures constant lubrication. The upper ball bearing carries both radial and thrust loads and is mounted in a specially designed cartridge, which is equipped with a series of compensating springs. The grinding wheel spindle is thus auto-



Springfield Vertical Surface Grinder

Shop Equipment News

matically kept free from any axial play or backlash.

The spindle is drilled its entire length to enable the cooling compound to be supplied to the inside of the grinding wheel. A ring wheel 18 in. in diameter is used, and is held in a chuck by means of a bronze clamping ring. This chuck in turn is bolted to the spindle faceplate, which can be readily removed for wheel replacement.

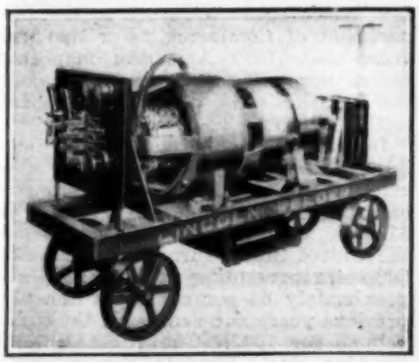
Power for traversing the table is furnished by a 7½-hp. motor mounted on a platform between the uprights. This motor is also used for elevating the cross rail and driving the coolant pump. A large coolant supply tank is located at the rear of the bed, where it is accessible for cleaning and filling.

The machine weighs approximately 15 tons.

Lincoln Improved "Stable-Arc" Welder

The Lincoln Electric Co., Cleveland, Ohio, has replaced nearly all gray-iron castings with welded structural steel in its improved 300-amp. a.c. "Stable Arc" welder shown in the accompanying illustration.

In this machine there are only two gray-iron castings, which weigh about 15 lb. total. The motor and



Lincoln Improved "Stable-Arc" Welder

generator rings, brackets, and connecting rings are all made of structural angles rolled up into the proper shape and welded together. The feet of the motor-generator set are made of drop forgings. The truck wheels are made of T-sections rolled on a special machine, and the hubs of the wheels are steel tubes.

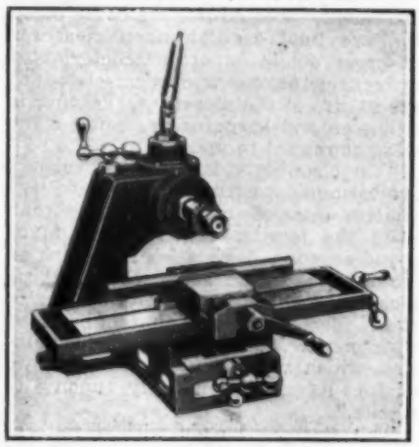
Even the control panels are made of sheet steel welded together and to the support instead of being the usual slate. Due to the fact that the steel parts will bend rather than break, it is said that the liability of failure has been greatly reduced, since the bent parts may be straightened and the equipment put in operation without waiting for replacement castings. In several cases the control panel has been crushed and the instruments and switches wrecked, but a temporary repair was made within an hour by straightening the panel and switches and omitting the instruments.

Hawkins Milling Attachments For Drill Presses

John W. Chapman & Co., Warsaw, Ind., has developed the Hawkins milling attachment for drill presses shown in the accompanying illustration. In addition to the regular milling operations that this machine will perform, it can be equipped to do turning work, such as is done on a lathe, by mounting a 3-jaw chuck on the spindle and fitting the table with a special tool holder for the cutting work. It can also be used as a cutting-off machine on bar stock and for light drilling, boring, and reaming operations. The machine is capable of performing precision work when required. It is made of high-grade gray iron castings.

The machine at present is built in two types, the plain type as shown in the figure, and a semi-universal type. Either can be successfully operated on any upright floor drill press 16 in. or larger. The total net weight is about 140 lb., so that it can be moved about from one part of the shop to the other.

The machine is driven from the drill press through a taper shank and universal joint, and the drive to the milling spindle is through steel bevel gears having a ratio of 1 to 1, so that the speed of the milling machine spindle is always the same as that of the drill press spindle to which it is attached. The spindle is made of high-carbon steel, ground, and runs in Shafer self-aligning taper roller bearings. The head is of the inclosed type so that the gears are continually operating in a bath of oil or grease. The entire head can be moved up and down on the column, and is fitted with a clamping mechanism which



Hawkins No. 2 Plain-Type Milling Attachment for Drill Press

rigidly holds it in place while the machine is performing cutting operation.

The head, table, and spindle all have independent hand feed adjustment. Feed screws have accurately-milled Acme threads and are equipped with graduated micrometer dials. All bearing surfaces are hand scraped to alignment, and the head, saddle, and table have adjustable steel gibs.

The size of table used on the plain type machine permits the use of various attachments, such as dividing heads, universal angle plates, swivel vises, and the like. This machine will use all standard milling cutters, and the spindle is equipped with a No. 9 Brown & Sharpe taper.

SPECIFICATIONS

	Plain	Semi-Universal
Length of table feed, in.	14	9¼
Adjustment in line with spindle, in.	4	4
Vertical adjustment of head on column, in.	6	5
Overall dimensions of table, in.	21¼ x 5½	8 x 4½
Working surface of table, in.	18 x 4½	8 x 4½
Maximum distance table to spindle, in.	6½	5½
No. of T-slots in table	1	2
Capacity of vise, in.	4 x 1¾	4 x 1¾
Net weight, lb.	150	140

NEWS OF THE WEEK

U. S. Chamber Protests Hasty Legislation

In a statement issued last week by John W. O'Leary, president of the Chamber of Commerce of the United States, a protest is registered against hasty decisions on important legislation now before Congress.

"It is perfectly apparent," says the statement, "that efforts are being made to have final decision upon measures of great public importance determined by considerations wholly unrelated to the nature of the measures. Trading is going on and bargains are being made without regard to merits.

"The chamber voices its most earnest protest against every effort to have legislative decision made otherwise than upon the merits. Much as we favor sound economic legislation and much as we believe in the soundness of those measures which we favor, we desire their enactment only on the basis of their merit. Much as we oppose legislation which we believe is unsound, we desire its rejection only upon its merits."

The statement ends with a reiteration of the Chamber's support of the McFadden-Pepper Bill and its opposition to the McNary-Haugen Bill.

Major Hoffman Gets Collier Trophy

Major E. L. Hoffman of the Army Air Corps, has been awarded the Collier Trophy for 1926, by the National Aeronautical Association, for the outstanding part he has played in the development of this important phase of aeronautical development.

The Collier Trophy, donated by Robert J. Collier, is awarded annually for the greatest achievement in aviation in America, the value of which has been thoroughly demonstrated by actual use during the preceding year. The first award of the trophy was made in 1913, to Glen H. Curtiss, for his development and demonstration of the flying boat.

Major Hoffman was assigned to McCook Field, Dayton, Ohio, as chief of the equipment section of the engineering division. It was while on this duty that he became interested in the development of the parachute. He drew up the specifications and made drawings for the first parachute ever purchased for the Army Air Corps.

As a result of the successful operations of parachutes, orders now make its use compulsory for all personnel during flights. Thus far there have been forty-two occasions in this country on which the parachute was instrumental in saving occupants of airplanes, whose lives became imperiled in the air by reason of collisions, failure of engine, fogs, or other causes. No other single device has been perfected to date to which equal credit can be given for the lives of aviators, or for an increase in the feeling of confidence and security while in the air.

Major Hoffman is now in command of Lunken Airport, Cincinnati.

Low-Powered Planes In International Air Races

Low-powered airplanes are to be admitted this year to international racing records for the first time, according to a decision recently made by the International Aeronautical Federation. In the future four new airplane records will be established as follows:

Longest distance in a straight line; longest distance in a closed circuit; greatest speed for 100 kilometers; highest altitude.

For each of these there will be two categories: The first for machines weighing a maximum of 200 kilos (440 lb.) and consuming a maximum of 12 kilos of essence per 100 kilometers. The second for machines weighing from 200 to 500 kilos with a consumption of essence less than 20 kilos per 100 kilometers.

The new competitions are expected to assist materially in popularizing in France the low-powered airplane which may become the popular sport air vehicle of the future.

Foundry Equipment Men See Good Quarter

At the annual meeting of the Foundry Equipment Manufacturers' Association, in Cleveland on Feb. 1, Thomas W. Pangborn, of the Pangborn Corporation, was elected president for the ensuing year. S. C. Vessy, W. W. Sly Manufacturing Co., Cleveland, was chosen vice-president; and H. Cole Estep, Cleveland, was re-elected secretary-treasurer. E. O. Beardsley, Beardsley & Piper Co., Chicago, and N. S. Lawrence, the Whiting Corporation, Harvey, Ill., were elected directors for three years.

The reports on business conditions in the foundry equipment field indicated that although there may be some uncertainty concerning the outlook for the whole year, the first quarter will bring satisfactory returns equal to the rate of operations last year.

Addresses were given at the meeting by W. J. Barrett, policyholders' service bureau, Metropolitan Life Insurance Co., New York, and Dan M. Avey, editor, *The Foundry*, of Cleveland.

Motor Drive Feature of Power Show

The fifth annual Electric Power Show, to be held in the New York Edison Co.'s showroom at Irving Place and Fifteenth St., New York City, Feb. 28 to March 5, will illustrate the latest developments in the industrial trend toward individual motor drive. About twenty manufacturers of electric power equipment will exhibit small industrial units, including electric drills, pumps, exhaust fans, cutting machines of all kinds, etc., driven individually by electric power.

A special feature will be made of electric pumps, which have become important features of the equipment of big buildings for pumping water and steam to the upper floors, along with the automatic devices for their control. There will also be woodworking machines used for making fancy pieces, scroll work, etc., and a miniature woodworking factory will be in operation in the showroom. Some newly perfected devices for industrial motor control will also be on display.

The show will be open free to the public from nine to six every day during the entire week.

U. S. Machine Tools Lead in South Africa

Competition from United States in machine tools has become increasingly evident in South Africa during the past few years, states a report to the Department of Commerce. For the first time since 1919 American manufacturers were able, in 1925, to displace the British as the dominant suppliers to this country.

Imports of machine tools (other than lathes, which are included under this classification and in which the American share is negligible) were valued at $119,300, during 1925. Of this amount the United States furnished a value of $68,234, representing an increase of approximately 84 per cent over the two previous years and nearly six times the volume for 1922. The value of total machine tool imports (other than lathes) during these years has been as follows: 1922, £7,380; 1923, £21,037; 1924, £23,314; and 1925, £24,711.

Although sharing proportionately in the increased business in 1923, British manufacturers have subsequently failed to keep pace with the improved demand, their ratio having dropped from slightly over 57 per cent in 1923 to somewhat below 38 per cent in 1925. As contrasted with this showing, the American participation has grown from about 26 per cent of the total imports in 1922 to nearly 60 per cent of the total in 1925.

Canadian Auto Industry Prospered in 1926

The year 1926 was a good year for the Canadian automotive industry. Complete figures for the year are not yet available, but the total number of vehicles turned out by the factories in the Dominion may be estimated at over 200,000. This figure represents a considerable increase over the previous high record which was 161,970 in 1925. The value of the products of the industry may be placed at $130,000,000 as compared with $110,000,000 in 1925.

The increase in production during 1926 was occasioned almost entirely by demands of the home market, for exports as compared with 1925 remained almost stationary. A complete survey of the home market in 1926 shows that it absorbed approximately 166,000 motor vehicles, of which 136,000 were made in Canada and 30,000 imported.

To a considerable extent, the increase in home market consumption has been due to a larger number of cars withdrawn from use than in previous years. This number is much greater than the 1925 estimated total of 26,059. The replacement market from now on is expected to prove an increasingly important factor in stabilizing sales volume. Canadians are getting the habit of turning their cars in at the end of a year or two and buying new models.

The output of the automobile industry in Canada during 1925 represented one car to every 60 of the population.

Gaining in Importance

The automobile industry in Canada is becoming more and more closely interwoven with the general industrial fabric of the country. At the beginning, automobile manufacture in Canada was largely confined to the assembling of imported units, but it has now advanced to a stage where most of the component parts of the leading makers of cars are fabricated in the Dominion. A recent investigation showed that several hundred industrial concerns located in fifty cities and towns throughout the Dominion had a substantial business in relation to supplying parts and materials to the automobile factories.

Reports submitted by more than 200 of these firms on their business in relation to the automotive industries made possible the compilation of the following figures:

Employees	11,597
Wages and salaries	$14,036,668
Capital investment	$47,126,840
Value of production at wholesale prices	$61,588,344

These statistics show that approximately as many persons are employed in parts and material factories as in the automobile factories. Altogether it is estimated that about 25,000 persons are employed in relation to automobile manufacturing in Canada, and that at least 100,000 people are being supported by the industry, without taking into account those engaged in the selling and servicing of motor cars. The combined yearly pay-roll of $32,000,000 represents more than $100,000 per day in wages and salaries paid to the employees of the industry.

Another important disbursement by the industry is that to the railways, which, it is estimated, exceeded $10,000,000 in 1926.

Final registration figures for 1926 are expected to show a total of more than 825,000 motor vehicles of all kinds in use in Canada, and that the prevailing rate of increase, with the excellent outlook, the million mark in registration should be reached early in 1927.

A.S.M.E. Meetings

The technical program for the Mid-West meeting of the American Society of Mechanical Engineers is rapidly being brought into completed form. This meeting, which will be held in Kansas City, April 4 to 6, will have an excellent collection of papers of interest to mechanical engineers. The council of the society will hold a business session on April 4. In the afternoon there will be a session on education and training for the industries. On Tuesday and Wednesday mornings a group of sessions will be held on petroleum, management, power, and fuels, with one session dealing with the mechanical progress of industries peculiar to Kansas City. The afternoon and evenings of the three days will be filled with inspection trips, industrial excursions and entertainment. Headquarters will be in the Hotel Baltimore, and members of the society are urged to make reservations at an early date.

The spring meeting of the society at White Sulphur Springs, May 23-26, is the first meeting of the society to be held at a resort since 1910. A large group of interested members is working on the entertainment events for the meeting, and such events will be in charge of J. C. Worker, chairman, Howard Butt, John F. Daggett, H. D. Savage, Charles E. Wilson, and Lewis F. Lyne, treasurer. A ladies' committee is being selected and the personnel will be announced at a later date. Each local section is being asked to appoint a representative to co-operate with the entertainment committee in giving publicity to and in increasing the attendance at the meeting.

The society has seldom held a Spring Meeting which promised the members so unusual an opportunity to spend a vacation under such ideal conditions.

The 1927 Year Book of the A.S.M.E. will be issued about Feb. 20, and will be mailed to those members of the society who have requested copies.

Railroad Repair Work

According to data collected in the biennial census of manufacturers, through the Department of Commerce, taken in 1926, the repair shops of the steam and electric railroads in this country reported work done during the year 1925 to the aggregate value of $1,332,679,000, which was a decrease of 12.3 per cent as compared with the value of work done during 1923. For steam roads the value of repairs was $1,248,867,000, a decrease of 12.9 per cent, and for electric roads the value of repairs was $83,812,000, which was a decrease of 3 per cent.

Effects of Dust on Lubricants

A series of laboratory experiments to determine the effect of road dust on the lubricants of automobiles has been concluded at the Bureau of Standards, Department of Commerce. The investigation involved a study of the performance characteristics of journal bearings when a fine abrasive was in the lubricant, a condition similar to that resulting from the presence of road dust and other solid matter in the crankcase oil.

Under severe operating conditions, road dust in the lubricant of an automobile will considerably increase friction losses, while at very light loads but little difference will be noted, according to the bureau. This fact makes especially important the precise determination of the effect of the dust on the durability of the affected parts of the engine, from a standpoint of service and economy.

The journal-bearing friction machine used in the tests provided a method of measuring the frictional loss in a journal bearing when operating under different conditions of load on the bearing, speed of shaft, and viscosity of the oil, and by correlating these facts in a suitable manner a comparison of the performance of different lubricants with a given bearing was obtained.

This comparison of the performance of straight mineral oils and that of the same oils plus a small percentage of a very fine abrasive shows that under very light conditions of service the friction loss of the bearing is about the same when using either the straight mineral oil or the oil plus abrasive. At more severe operating conditions, however, the friction loss when using the oil plus abrasive is greater than that when operating under identical conditions with the straight oil.

These results give a measure of the friction loss and an indication of the rate of wear caused by the abrasive, and indicate that there is at least a promising field for further research with reference to the factors affecting the wear of journal bearings.

Japan Will Enter Auto Field

Acting under instructions from the national government committees have been investigating the problem of developing domestic automobile manufacturing industries. These committees have been studying methods, and plans have been materialized. It is planned to increase the import duty on completely manufactured automobiles, and on parts of automobiles; but allowances are to be made for the import of machinery for manufacturing automobiles and parts;

Taxes on automobile manufacturers and owners are to be adjusted. Priority of right to manufacture or to license the special manufacture of automobiles or parts is to be established.

Encouragement is to be given automobile manufacturers to co-operate.

The Land Expropriation Law is to be made applicable to auto builders.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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SOME Wall Street men who are old enough to recollect 1901 profess to see in last week's stock market conditions that resemble those which prevailed at the time of the famous Northern Pacific corner, twenty-six years ago. The contest for the control of the Wheeling & Lake Erie Railroad, which brought about a corner in the stock; the wild upbidding of other low priced railway stocks; and the concurrent selling of industrials by those who have taken alarm at the hectic speculation in rails were the resemblances marked. But conditions otherwise are very different, and the idea that last week's episode will lead to anything like a panic seems unwarranted.

The announcement that the New York Central and the Baltimore & Ohio, with the Van Sweringens, now control the Wheeling & Lake Erie, and that the same interests have also acquired a majority of the stock of the Western Maryland, has attracted wide attention. It is construed as foreshadowing a struggle for domination in the railroad world. But those who are engaged in this struggle appear to be well financed and it is not likely that their operations will be permitted to work general unsettlement if the public will continued to stay out.

For the same reason, however, the line of cleavage between the industrials and rails is becoming more apparent day by day in the stock market. The industrials will probably reflect the trend of business whil' the rails will continue to be moved about by those who are maneuvering for position in the transportation game that is being played with the railway map as a chess board. Under the circumstances it is impossible to say what any particular railroad stock may be worth.

Insofar as the industrials are concerned they seem to reflect the admitted recession of business from last fall's level and the anticipation of a comparatively quiet spring. But this may be changed if the McNary-Haugen bill passes and lifts the value of our agricultural products as many predict it will. In the East economists are opposed to the bill. But if it becomes a law it will have to be dealt with as a condition rather than a theory. Washington believes that it will be passed but there is some doubt whether the President will sign it and until this doubt is dispelled the commodity markets are likely to remain nervous. Cotton has advanced rather sharply while wheat, corn, rice and hog products, the other commodities included, show no preceptible change.

From industry and distributive trade no clear picture of what lies ahead has yet emerged, but reports from some important quarters are more cheerful. The iron and steel reviews note a broadening demand and expect that February's record will be better than January's, while prices are more stable at the lower levels recently reached. Automobile sales and production are also showing their seasonal increase and will soon reach satisfactory proportions again, and it would be illogical to see in January curtailment an indicator of February depression.

In building, however, the prospect of improvement is less clear. Contracts awarded in January were 16 per cent under a year ago, according to the F. W. Dodge Corporation, and permits during the same month, as recorded by *Bradstreet's* were 13.6 per cent smaller. In New York City the real estate people calculate that 61,252 apartments that would house 200,000 people are vacant, and it seems that the construction industries must lean heavily upon public works and engineering projects to take up the slack in home building. But money is so abundant and cheap that the total of such projects is enormous.

While the industries thus fluctuate, retail trade is excellently maintained, and it is self-evident that if manufacturing temporarily reacts to a lower level than consumer buying it must soon rise equal to it again. Department store sales during January were one per cent larger than a year ago, the Federal Reserve Board reports, and chain stores showed a large gain. Wholesale trade has increased in some lines and requests that new orders should be rushed are common enough to show that hand-to-mouth buying has kept stocks at a minimum even where, as is the case with cotton mills, orders for two to three months are now on the books.

The price trend is still downward in the majority of commodities, which is itself assurance against overstocking. A sharp decline carried copper down to 12½ cents last week; it is now steadier at a slight recovery. Apparently the record consumption last year and the brilliant prospects before the electrical industry generated overconfidence and overproduction among the copper companies. In rubber an easy undertone has reflected accumulating stocks.

And finally is the continued ease of money, which is indicated by another gain of $18,500,000 in gold in last week's Federal Reserve Banks' statement and a further drop in discounts, which are $154,000,000 smaller than a year ago.

This is a detailed portrayal of a business situation which Henry Ford says is "as solid as a rock." The fissures that are discernible on close inspection do not impair the soundness of the structure and no blasts that would widen them are likely to go off.

WHAT'S DOING IN INDUSTRY

ANALYSIS of reports from industrial centers indicates an improvement in general conditions, and a noticeable increase in sales and inquiries in the machine tool field. A spotty condition still prevails, however, and there is no apparent definiteness about the future.

CHICAGO notes a perceptible improvement, with railroad purchases furnishing the motive. Orders from a scattered territory were received in Cincinnati and the volume of inquiries is satisfactory. Cleveland reports an increase in sales since the first of the month. Milwaukee describes present activity as conservative with sales in fair volume. Uneven production at some of the automobile plants has made business in Detroit uncertain.

PHILADELPHIA dealers say that business is steady, while in New York the receipt of some good orders has renewed optimism. A fair volume of sales and some foreign inquiry is reported from New England. The month shows improvement in Buffalo.

THE FISSURES that are discernible in the present business structure are not serious enough to cause any unsoundness, and there appear no possibilities of a blast that might widen them.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

MILWAUKEE

The trend of the demand for metal working equipment continues upward, although a definite degree of conservatism is still strongly apparent in buying. The automobile shops are still satisfied to meet necessary replacement needs, although additions to capacity are contemplated as soon as the situation clarifies with respect to the retail market.

General industrial demand is the principal sustaining force in the tool trade. While there is a moderate inquiry from railroads, new business in this quarter is developing slowly and hardly in line with expectations expressed earlier and based on the inquiry several of the large systems have been putting forth.

In a general way, business in all lines of industry is proceeding in a more satisfactory manner than was expected during the closing days of 1926. Employment in Milwaukee at the middle of February showed a material increase over recent months and stood close to the peak point of last year.

BUFFALO

Machine tool dealers in Buffalo report that January business was not as good as that of the same month last year, but indications are that February will show marked improvement. Inquiries are better than in January and dealers who were somewhat chagrined by the way business began in January are now more optimistic.

Demand for contractors' equipment is reasonably dull and the sale of snow removal equipment for use on highways has been halted temporarily because snow in this section disappeared late in January. The demand for electrical equipment for industrial uses is quiet and far from being as active as a year ago. However, a feeling of optimism prevails. Collections generally are reported to be not as good as last year, but February may show an improvement.

CHICAGO

A perceptible improvement in the condition of the machine tool market during the last week is reported from various sources. While the increase in the volume of business has not been large, it is regarded as indicative of the beginning of an upward curve which is likely to continue. A number of worth-while sales have been closed, and inquiries are increasing and taking on a more concrete form.

Railroads are among the chief factors responsible for this improved situation. Although no budgets are known to have been completed by railroads, it is stated that within a few weeks lists will be issued by two or more of the Western trunk lines, the St. Paul and the Northern Pacific being mentioned as among the roads which will be heard from in closing some orders they recently placed.

Among the industrialists the Illinois Steel Co. is again inquiring for tools, in connection with the company's shops at Gary, Ind. Electrical and machinists' tools continue in excellent demand. In wood working machinery the situation is reported to be better than for some weeks past, and manufacturers of this class of machinery who last week met in convention in this city are optimistic of the future.

A budget of $27,000,000 for new equipment to be purchased during 1927, lately announced by the Rock Island lines, the largest in the history of that road, includes new yards at Joliet and Peoria, Ill., and the enlargement and improvement of shops and roundhouses in Chicago.

NEW ENGLAND

Machinery builders in the New England section report buying in fair volume during the past week. The requirements are general and represent a wide range of equipment. According to expressions of officials interviewed, the West was well represented in business placed, but not so numerous in the solicitations for quotations. The nature of inquiries received had the flavor of hand-to-mouth buying.

Production machinery builders, taking courage from better conditions prevailing, are ordering schedules in anticipation of continuance. Small tool manufacturers are also increasing schedules slightly. Special machinery manufacturers are busy.

Foreign business prospects appear brighter, in the opinion of executives in this section. Some fairly large shipments were recently made.

The Pratt & Whitney Aircraft Co., has announced receipt of a contract from the Boeing Aircraft Co., of Seattle, Wash., for twenty-five 400-hp. "Wasp" engines, the cost of which will be about $250,000. Production will begin at once and the output will be doubled. Plans are being made accordingly. The company now employs 150 machinists and plans to increase the number at once. The present output is fifteen engines monthly.

CLEVELAND

Dealers and manufacturers of machinery and machine tools report an increase in business since February first. A good volume of buying of single pieces from a wide variety of industrial sources has come into the local market. New lists are more frequent and a tendency is noted for a larger number of tools. Several concerns are working on prospects that will mean above the average business when consummated.

Sales for January slightly exceeded the December volume. A steady trend of business is expected throughout February and March. A shipment of tools for a sugar plant in England was one of the recent large orders placed locally.

PHILADELPHIA

Dealers and manufacturers in machinery lines in Philadelphia reported a steady volume of business during the last two weeks. Some of those dealing in special machinery, such as that used in textile plants, reported a small business, and industrial construction appeared to be considerably reduced, judging from reports from industries producing materials.

The Ford Motor Co. entered the Philadelphia market for some electric hoists. The Auto Car Co., of Ardmore, Pa., and the Chapman Valve Co., made some sizeable purchases of similar equipment, the latter for its plant in New England.

Manufacturers of abrasives and abrasive wheels reported a fairly active business, with some Eastern railroads in the market. Industrial concerns generally throughout the country have been purchasers of various types of gears. Companies engaged in the manufacture of machinery for the repair of locomotives reported business somewhat retarded, with inquiries failing to reveal prospects of an immediate increase.

DETROIT

Business reported by machinery dealers in this city shows that the market is spotty. The expected increase in volume of sales has not materialized and dealers are skeptical about the future. Present buying is confined mostly to orders for single machines and some small toolroom equipment. Nearly all the motor car manufacturers have been active in this way but none are buying large quantities, as had been expected.

While some of the automobile plants are running at capacity, there are many that are still marking time. Buying by the latter class is practically nil. General machine plants and industrial users of machinery are inactive.

CINCINNATI

Reports of machine tool manufacturers in the Cincinnati district indicate an improvement in market conditions in the past week. The majority of concerns stated that there was a slight increase in sales and in no case was it reported that business had fallen off. Selling agents reported that the market became slightly more active through the week.

The feature of the week's market was the sale of single tools and replacements. Orders for these came from all classes of users, located in all sections of the country. A portion of the orders booked called for several tools, some of these being reorders of tools that had been bought for experimental purposes. Railroads made a few scattering purchases of single tools and a few orders came from the automobile field.

A feature reported in connection with the present market is that the lapse of time between inquiries purchases is diminishing. Manufacturers and selling agents state that if only a small percentage of the inquiries on hand result in sales there will be sufficient business to keep plants busy.

NEW YORK

The placing of some substantial business in this market in the past week has served to restore some of the optimism that prevailed earlier in the month. While present orders are confined to a miscellaneous selection of machines, the total volume is quite satisfactory. More than one dealer reported the receipt of business that represented a fair expenditure of money.

Most plants in the metropolitan area are busy, and there appears no apparent reason for a slow down. It is believed, however, that the uncertainties of future demand for some products are holding up orders for shop equipment that have already passed the confirmation stage. Inquiries continue to come in at a satisfactory rate.

Toolroom equipment — bench millers, grinders and drills, and small jig borers — are represented in current sales. A car wheel borer, a worm grinder, a large shaper, and a quartering machine were also ordered. The Rochester Gas and Electric Co. purchased a 75-ton crane. The Chicago & Eastern Illinois R.R., the Illinois Steel and the Franklin Automobile Co. were among those who placed orders.

Begin Lecture Course on Aviation Medicine

A ten lecture course in aviation medicine was begun last week at the Georgetown University Medical School, through the co-operation of the Department of Commerce.

Georgetown is the first medical school in the country to include such a course in its curriculum. The lectures will be given by Dr. Louis H. Bauer, medical director of the aeronautics branch, Department of Commerce, who is in charge of the medical examinations of pilots applying for Federal licenses.

Dr. Bauer has spent 13 years in the Medical Corps of the Army, of which seven and one-half were in the Air Service. He organized the School of Aviation Medicine at Mitchell Field, and was commandant of that unit for six and one-half years. He is the author of "Aviation Medicine," in addition to many articles in regard to flight surgeon's duties.

The lectures will be given once a week, and will cover a general survey of the subject, as much detailed discussion as possible, and probably a demonstration of apparatus for examining pilots and applicants. Dr. George M. Kober, dean of the Medical School at Georgetown, is directly responsible for approval of this addition to the present subjects of the institution.

Dr. Jeffries Awarded Douglas Medal

At a meeting on Feb. 16, of the American Institute of Mining and Metallurgical Engineers, held in connection with the organization's annual meeting in New York, the James Douglas Medal for 1927 was presented to Dr. Zay Jeffries, prominent metallurgical engineer associated with the General Electric Co. at Nela Park, Cleveland. The medal was awarded to Dr. Jeffries in recognition of his work in research and achievements in the field of non-ferrous metals.

Dr. Jeffries has been active in research work in metallurgy and has been prominent in the work along this line conducted by the various technical societies in the engineering field. For several years he has been associated in the research work of the General Electric Co.

General Electric Wins Sesqui Awards

The General Electric Co. has been awarded two grand prizes, three medals of honor and nine gold medals for electrical equipment displayed at the Sesqui-Centenial Exposition.

One of the prizes was awarded for "Systems of Electric Transportation and Traffic Regulation Devices." This recognized the electric locomotive, street car eqluipment, automobile motors, Novalux traffic signals, and an aviation beacon exhibited by the company. The other grand prize was awarded for "Excellence of Products and Service to Humanity."

One medal of honor was awarded for "Gas-Electric System of Drives for Buses," one for "G-E Mazda Lamps," and one for "Turbine Super Charger."

Gold medals were awarded for automatic induction voltage regulator, for a.-c. and d.-c. motors, for direct-current generator—marine type, for electric fans, for an electric mine locomotive, and for an emergency automatic throw-over switch.

N. Y. U. Course in Management

The school of commerce and finance of New York University announces a series of lectures and discussions on the "Technique of Personnel Management," to be given over a period of weeks between Feb. 1 and May 10. The instructor in charge will be Harold B. Bergen, manager of the personnel department of Henry L. Doherty & Co.

Industrial Notes

Orders for sheets are increasing. Automobile manufacturers are taking more tonnage and resumption of usual consumption of sheets is expected within the next 30 days. Farm implement manufacturers are taking good tonnage. Sheet mill operations are increasing. The American Sheet and Tin Plate Co. is operating its sheet mills at about 60 per cent and its tin plate mills at capacity.

The Department of Commerce lists December booking of steel castings as 65 per cent of shop capacity against 53 per cent in November and 78 per cent a year ago. Production of steel castings was 62 per cent of capacity in December against 65 per cent in November. Total booking for 1926 amounted to 990,246 tons.

A net income for 1926 estimated at $70,000,000, equivalent to 14 per cent on capital stock, the best showing in 35 years, tells of the recovery of the Pennsylvania Railroad from war's depression. The year 1926 will go down in Pennsylvania annals as one of marked achievements. Car loadings for the year established a new high record. Net income set a new high record. Earnings on the stock were the largest in 35 years. Dividend was increased to 7 per cent. Further improvement was attained in operating efficiency.

Approximately $100,000,000 will be spent in the development of the railroads of South America this year and a large part of the new financing will be done in the United States.

The Chilean government is negotiating a $40,000,000 loan in New York for the electrification of the Chilean State Railways.

The Bolivian government has virtually closed a deal with a group of New York bankers for a $15,000,000 loan for railroad construction. A loan of $10,000,000 will be advanced by a New York group for the development of Peruvian railroads.

Argentina has approved plans and estimates amounting in the aggregate to about $30,000,000 for extension works on the state railways.

The cost of new machinery installed in the Detroit finishing plant of the Edward G. Budd Manufacturing Co., and the installation of new equipment in its plant in Philadelphia, has caused the management to decide against the payment of the current dividend on common stock. A statement issued by Edward G. Budd, president of the company, declared that "in the last six months of 1926, the company took on added contracts which practically doubled its business.

"This necessitated the establishment of a finishing plant in Detroit and the installation of a great deal of machinery in both Detroit and Philadelphia, and the installation cost of this new business was necessarily great and in some cases exceeded our estimates."

Mr. Budd estimates that before the end of the present year the earnings will justify the payment of the regular dividends for 1927. More than one-half the common stock is owned by officers of the company.

Personals

W. E. RAHM has been appointed sales manager of the Watson-Stillman Co., of New York.

PHILIP ROBINSON has been elected vice-president and general sales manager of the Gary Screw and Bolt Co., of Gary, Ind.

L. B. PATERSON has been appointed assistant production manager of the Combustion Engineering Corporation, of New York. He was formerly with the American Locomotive Co.

C. E. MCGREGOR has been appointed sales representative in Chicago for the Brown Instrument Co., of Philadelphia. He was formerly with the Republic Flow Meters Co.

J. P. TIERNEY has become president and manager of the General Machinery Corporation, of Boston.. He was for twenty years associated with Hill, Clark & Co., of Boston.

J. G. ANDERSON has been appointed superintendent of the Rockford Machine Tool Co., Rockford, Ill. He was formerly associated with the Rockford Lathe and Drill Co.

C. B. ROSE has been elected vice-president of the American La France Fire Engine Co., Inc., of Elmira, N. Y. He was formerly vice-president and general manager of the Fageol Motors Co.

H. C. WOODSUM has been appointed assistant to the manager of the Boston Gear Works, Norfolk Downs, Mass. He was formerly manager of advertising and sales promotion.

ALLIE J. STROHMEYER has been assigned to the New York office of the Kearney & Trecker Corporation, of Milwaukee. Mr. Strohmeyer will have charge of consulting and service work in the metropolitan district.

W. H. SMITH has been elected president and treasurer of the Pattison Supply Co., to succeed the late Wm. N. Pattison. Other officials elected were: C. E. McComb, first vice-president; Charles Pattison, second vice-president; A. C. Vaughan, secretary and assistant treasurer.

H. O. K. MEISTER has been appointed general sales manager, and A. W. Scarratt chief engineer, of the Hyatt Roller Bearings Co., Newark, N. J. Mr. Meister joined the Hyatt forces more than fourteen years ago. He was recently appointed assistant sales manager with headquarters at Newark, where he will continue to be located as general sales manager. Mr. Scarratt has been engaged in the design and construction of automotive, tractor, railroad and industrial equipment. He joined the Hyatt engineering staff a few months ago as assistant chief engineer.

Obituaries

S. S. NEWTON, one of the founders and for many years president of the Luther Grinder Manufacturing Co., of Milwaukee, died at his home in that city recently. He was 76 years old.

BENJAMIN N. BROIDO, chief industrial engineer for the Superheater Co., of New York, died on Feb. 10 at his home in that city. Mr. Broido was a member of the American Society of Mechanical Engineers and of the Engineers' Club of Philadelphia.

SIR JAMES KEMNAL, one of the pioneers in the development of electrical power in Europe, died on Feb. 9 in London, England. He was managing director of Babcock & Wilcox, Ltd., and was president of the Latin American and British Chamber of Commerce.

ALBERT BALL, inventor of the Ball repeating rifle, diamond core drill and other devices, died in his home in Claremont, N. H., on Feb. 7, at the age of 90. For half a century he was chief mechanical engineer for J. P. Upham & Co., and its successor, the Sullivan Machinery Co., of Claremont.

Business Items

The Trico Fuse Manufacturing Co., of Milwaukee, announces that it has established a complete stock department at the warehouse of its representative, the Albert S. Knight Co., in Seattle, Washington.

The Norwood Engineering Co., Northampton, Mass., has acquired a controlling interest in Mahew Steel Products, Inc., of Shelburne Falls, Mass. G. W. MacDow will manage the two plants.

The Power-Way Manufacturing Co., of Brooklyn, N. Y., has leased the plant formerly occupied by the Feeney Tool Co. in Bridgeport, Conn. In its new quarters the company will have approximately 5,000 square feet of available floor space.

The Niles-Bement-Pond Co. has been appointed exclusive sales agent in the United States, with the exception of Cleveland and Detroit, for the Boye & Emmes Machine Tool Co., of Cincinnati, manufacturer of engine lathes.

The Watson Brothers Machine Co., of Bound Brook, N. J., has purchased the business, patterns and good will of the Bushnell Press Works, at Thompsonville, Conn., manufacturer of baling presses, and is moving the shop equipment to New Jersey.

The Motor Tool Specialty Co., of Chicago, has established a branch at 403 Twenty-first St., South, Birmingham, Ala., to handle the group of Southeastern states. A. L. Soncrant is in charge of the new branch, and also supervising the Atlanta and Jacksonville offices.

The Scovill Manufacturing Co., of Waterbury, Conn., held its annual meeting on Feb. 8, and re-elected Edward O. Goss as president. The board of directors was increased from 9 to 11 members. The two new members of the board are: Bennett Bronson and J. P. Elton.

Articles of incorporation have been filed by the Montpelier Foundry and Machine Co., of Fort Wayne, Ind. The company will do a general foundry and machine business. The incorporators are Max B. Fisher, William L. Moellering and John N. Landenberger.

The Pittsburgh offices of the Hyatt Roller Bearings Co., of Newark, N. J., are now located at 806 Fulton Bldg., in that city. They were formerly at 1352 Union Trust Bldg. The new location provides for the increased sales and engineering forces of the new central division, functioning under the direction of B. H. Lytle.

The Boston Iron and Metal Co., of Baltimore, has sold the main part of the Groton Iron Works plant at New London, Conn., to the Atlantic Coast Fisheries Co., of New York. The Sea Sled Co., Ltd., which occupies part of the plant, will continue operations and has an option to buy its present space.

Yancey Bros., of Atlanta, manufacturers and distributors of road building and contractors' equipment and farm machinery, have started the construction of a new building at Albany, Ga., to be occupied by the company as a branch for the handling of the company's trade in the south Georgia and Florida territory. The new branch will be opened March 1.

The Driggs Aircraft Corporation has been organized at Lansing, Mich., to manufacture airplanes. Harry F. Harper, president and general manager of the Motor Wheel Corporation, is president of the new company. Other officers are: Ivan H. Driggs, vice-president and general manager; E. C. Shields, secretary; Hugo Lundberg, treasurer. Directors include R. E. Olds, Donald Bates, Ray Potter, J. T. Hopkins and H. T. Thomas.

The Hill Clutch Machine and Foundry Co., Cleveland, Ohio, recently appointed Charles C. Phelps, 473 Getty Ave., Paterson, N. J., as sales engineer for the New York and northern New Jersey district. The Hill Clutch Machine and Foundry Co. manufactures shafting, couplings, bearings, clutches, pulleys, sheaves, belt tighteners, speed transformers, agitators, gears and sprockets.

The Walker Vehicle Co., of Chicago, manufacturer of electric street trucks, has acquired control of the Automatic Transportation Co., of Buffalo, manufacturer of industrial electric trucks, tractors and material handling devices. G. A. Freeman, vice-president of the Walker company, has been elected president of the automatic firm. E. L. Kleindinst has been appointed vice-president and general manager of the new organization. R. J. Mulholland is sales manager.

The Relay Motors Corporation, recently incorporated to take over all assets of the Commerce Motor Truck Co., of Ypsilanti, Mich., and the Service Motors, Inc., of Wabash, Ind., announces the officers of the amalgamated company. W. R. Bassick, chairman of the board of directors of the new company is known to the automotive world as former vice-president of the Bassick Co. G. L. Gilliam, president of the Relay Motors Corporation, was president of Service Motors, Inc., prior to the amalgamation. M. A. Holmes, vice-president, will have charge of all sales. A. K. Taber, formerly treasurer of Service Motors, Inc., is secretary and treasurer of the new company.

Work on preparing the Terre Haute plant of the American Steel Co., of Indiana for the manufacture of steel products is such that the plant will being operation about March 15. The main factory building is that owned by the old Steelton plant in that city, but it is being moved some distance to a new location. The first annual meeting of the stockholders was held recently and the following directors named: J. E. Waterman, J. W. Ricker, George C. Foulkes, J. R. Finkelstein, John A. Templeton, F. R. Miller, M. E. Williams, L. C. Febring, H. E. Merrifield, F. R. Wolfe, Ben Blumberg, Ike Silverstein and W. H. Hahde. The following officers were elected: George C. Foulkes, president; J. W. Ricker, first vice-president; F. R. Wolfe, second vice-president; Edward Halsey, secretary; L. F. Waterman, treasurer and J. R. Finklestein, general manager.

Calendar of Local Meetings

A.S.M.E.

Cincinnati. Feb. 24. Cincinnati Engineers' Club. "Individuals in Industry Dealing with Occupational Diseases," by Dr. Cary P. McCord.

Cleveland. March 1. Carnegie Hall. "Aluminum and Its Alloys," by Dr. Zay Jefferies.

Metropolitan. Feb. 25. Engineering Societies' Bldg., New York City. General meeting under the auspices of the woodworking and the management sections.

Newark. March 28. Down Town Club, Newark, N. J. Sectional meeting of the Machine Shop Practice Division. "Plant Maintenance," by G. H. Ashman, of the General Electric Co.

National Association of Cost Accountants

Philadelphia Chapter. Feb. 18. "Some Faults of Present Cost Systems."

Kansas City Chapter. Feb. 21. "Predetermined vs. Actual Costs in Loss and Gain Statement."

Utica Chapter. Feb. 21. "Cost of Distribution or Selling, and Administrative Costs," by L. E. Vannais.

Detroit Chapter. Feb. 24. "Cost Accounting as a Basis for Shaping Operating Policy," by A. W. Bass.

Erie Chapter. Feb. 21. "Problems of Departmental Cost," by C. R. Stevenson.

Buffalo Chapter. Feb. 24. "Distribution of Selling Expense by Class of Product and Territories," by Albert E. Grover; and "Essential Records for Management," by George Frampton.

San Francisco Chapter. Feb. 28. "The Determination, Classification and Distribution of Administrative and Selling Costs."

Forthcoming Meetings

American Railway Association. Engineering Division, March 8 to 10, at Chicago; Mechanical Division, June 7 to 10, at Montreal; Purchases and Stores Division, date and place not yet announced. H. J. Forster, secretary, 30 Vesey St., New York City.

American Society of Mechanical Engineers. Regional meeting, Kansas City, Mo., April 4 to 6. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

American Society for Steel Treating. Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

National Foreign Trade Council. Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

Society of Industrial Engineers. Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer meeting, French Lick Springs, Ind., May 25 to 28. C. E. Heywood, manager of meetings department, 29 W. 39th St., New York City.

National Association of Purchasing Agents. Annual meeting and "Informashow" at Grand Rapids, Mich., June 6 to 9. W. L. Chandler, secretary, Woolworth Bldg., New York City.

American Foundrymen's Association. Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Supply and Machinery Distributors' Association. Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association,** and the **American Supply and Machinery Manufacturers' Association,** on board the steamship *Noronic.* Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia.

American Society for Testing Materials. Annual meeting at French Lick, Ind., June 20 to 24. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

National Machine Tool Builders' Association. First exposition of machine tools, at the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, chairman of the exposition committee. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Bldg., Cincinnati. Roberts Everett, manager of the exposition, 1328 Broadway, New York City.

The Weekly Price Guide

Rise and Fall of the Market

BETTER demand for railway and automotive steel marks the current situation in shop materials and supplies. Tin plate movement is also active. Copper has hit the lowest levels touched during the last three years or so. Iron tends downward, carrying with it steel products such as wire goods, bars, shapes, plates, sheets, semi-finished material and cold-rolled strips. Bars are $1.90@$2 per 100 lb., at Pittsburgh mill; shapes and plates bring $1.90, with an occasional mention of $1.80 per 100 lb.

(*All prices as of Feb.* 11)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	23.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00@4.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.15@2.25	3.50	3.15	3.89
No. 12	2.20@2.30	3.55	3.20	3.94
No. 14	2.25@2.35	3.60	3.25	3.99
No. 16	2.35@2.45	3.70	3.35	4.09
Black				
Nos. 18 to 20	2.95@3.05	3.75	3.25	4.15
No. 22	3.10@3.20	3.90	3.40	4.30
No. 24	3.15@3.25	3.95	3.45	4.35
No. 26	3.25@3.35	4.05	3.55	4.45
No. 28	3.40@3.50	4.20	4.70	4.60
Galvanized				
No. 10	3.15@3.25	4.10	3.95	4.40
Nos. 12 to 14	3.25@3.35	4.20	4.05	4.50
No. 16	3.35@3.45	4.30	4.15	4.60
No. 18	3.50@3.60	4.45	4.30	4.75
No. 20	3.65@3.75	4.60	4.45	4.90
No. 22	3.70@3.80	4.65	4.50	4.95
No. 24	3.85@3.95	4.80	4.65	5.10
No. 26	4.10@4.20	5.05	4.90	5.35
No. 28	4.35@4.45	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
120" or 125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	4.50	6.00@7.50	4.65
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛, 8.35c.; ¼, 7.85c.; ⅝ to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.87½
Tin, 5-ton lots, New York			71.25
Lead (up to carlots) E. St. Louis	7.27½	New York	8.00
Zinc (up to carlots) E. St. Louis	6.65	New York	7.50

	New York	Cleveland	Chicago
Antimony (Chinese) ton spot	17.00	18.50	16.00
Copper sheets, base	21.50	21.25	21.75
Copper wire, base	18.50	18.50	15.37½
Copper bars, base	21.12½	20.87½	21.37½
Copper tubing, base	23.50	23.75	23.75
Brass sheets, high, base	17.87½	17.62½	18.12½
Brass tubing, high, base	22.75	22.50	22.50
Brass rods, high, base	15.62½	15.37½	15.87½
Brass wire, high, base	18.37½	18.12½	18.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	27.00	26.02
Zinc sheets (casks)	13.00	12.30	11.36
Solder (½ and ½), (case lots)	42.00	43.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	88.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	13.25

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	39.00	Shot	36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.25 @11.50	10.25	10.25@10.75
Copper, heavy, and wire	10.62½@11.12½	10.50	9.50@10.00
Copper, light, and bottoms	9.25 @ 9.50	9.00	8.50@ 9.00
Heavy lead	6.12½@ 6.37½	6.25	5.50@ 6.00
Tea lead	4.25 @ 4.50	4.25	4.50@ 5.00
Brass, heavy, yellow	6.75 @ 7.12½	7.00	6.50@ 7.00
Brass, heavy, red	8.75 @ 9.25	9.25	8.50@ 9.00
Brass, light	5.25 @ 5.50	5.50	5.75@ 6.25
No. 1 yellow rod turnings	7.25 @ 7.50	7.25	7.00@ 7.50
Zinc	4.00 @ 4.12½	4.00	3.00@ 3.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.75@8.00	6.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.13	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	15
Sal soda, per 175 lb. keg	2.80	2.75	2.75
Roll sulphur, per lb	04	.03½	.04
Linseed oil, per 7½-lb. gal., 5 bbl. lots	.84	.98	85
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	55	50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	33	35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb	.1587½	.1637½	.1662½
Solder (½ and ½)	per lb.	42	.41	.3925
Cotton waste	per lb.	.13@17½	13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.33	35	35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.13
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.32
Cloth	3.10	3.50	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	3.50@4.00
Coke, prompt foundry, per net ton		Connellsville,	4.50@5.50
White lead, dry or in oil,	100 lb. kegs	New York,	15.25
Red lead, dry,	100 lb. kegs	New York,	15.25
Red lead, in oil,	100 lb. kegs	New York,	16.75

SHOP SUPPLIES

Machine bolts, ¾x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%

Carriage bolts, ¾x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%

Nuts, semi-finished, ¾x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ¾x½-in., 6c. each, less 50%

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{7}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.: ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.: less than 200 lb. 50c.; countersunk heads, 45c

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Chelsea (Boston P. O.) — New England Construction Co., Spruce St., D. Grossman, Purch. Agt.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $50,000.

Mass., Watertown (Boston P. O.) — Kiernan Duffy, 15 Hunnewell Ave., Brighton—miscellaneous tools and equipment for proposed auto repair shop on North Beacon St. here.

Mich., Lincoln Park—Universal Cooler Corp., 605 Book Bldg., Detroit—equipment for the manufacture of electrical supplies and machinery for proposed new unit to plant. Estimated cost $100,000.

N. Y., Belmont—William Laidlaw, Inc.—(metal cutting band saws) — additional equipment for proposed extension to plant.

N. Y., Buffalo—Acme Steel & Iron Works, 245 Military Rd.—lathes and small tools for finishing castings, etc., for proposed addition to plant. Estimated cost $150,000.

O., Oxford—H. Kopp, Park Pl., H. Kopp, Purch. Agt.—complete equipment for garage and repair shop now under construction.

Okla., Tulsa—Hinderliter Tool Co., A. W. Leonard, Pres., 14 North Madison St.—electric cranes, forging hammers, one about 6,000 lbs. and other automatic equipment for proposed 150 x 300 and 150 x 150 ft. extensions to plant. Estimated cost $750,000.

Man., Winnipeg—Plewes Ltd., 199 Princess St.—lathes of various sizes.

N. B., St. John — Battery & Electric Service Ltd., 102 Duke St., C. W. Parent, Purch. Agt.—miscellaneous tools and equipment including lathe suitable for turning commutator and other work.

N. B., St. John—T. C. Breen, 63 Elm St.—miscellaneous tools and equipment including lathe, etc.

Que., Montreal—P. Lafrance, 15 d'Isreali Pl.—complete equipment for blacksmith shop at Deserables and d'Isreali Sts.

Sask., Saskatoon—Richardson Road Machinery, Ltd.—complete equipment for plant to replace fire loss. Estimated cost $50,000.

Opportunities for Future Business

Ala., Birmingham—City Comn., awarded contract for the construction of a 2 story, 50 x 125 ft. fire station and repair shop, etc., at 19th St. and 4th Ave. Estimated cost $150,000.

Calif., Bakersfield—Kern County will readvertise for bids for the construction of a machine shop. C. H. Biggar, Bank of Italy Bldg., Archt. Former bids rejected.

Calif., Los Angeles—Bd. of Education, will soon award contract for the construction of a high school including 75 x 149 ft. shop building, at Denker Ave. and 109th St. Estimated cost $500,000. Dodd & Richards, 905 Brack-Shops Bldg., Archts.

Calif., Los Angeles—Bisch & Salzman, 1837 East 16th St., is having plans for the construction of a 1 story, 130 x 179 ft. wood carving and cabinet shops on East 16th St. J. E. Kunst, Cotton Exchange Bldg., Archt.

Calif., Los Angeles—F. C. Hill, Merchants National Bank Bldg., awarded contract for the construction of a 13 story, 78 x 155 ft. garage on Spring St. Estimated cost $450,000. Noted Feb. 10.

Calif., Los Angeles—White Motor Co., W. T. White, Chn of Bd. of Directors, 842 East 79th St., Cleveland, O., plans the construction of an auto sales and service station here. Estimated cost $150,000. Hughes & Conrad, Union Mortgage Bldg., Cleveland, O., Archts. H. R. Hadlow, c/o owner, Engr.

Calif., Stockton—C. M. Menzies, Cole Motors Inc., 332 North El Dorado St., plans the construction of a repair shop and service station. Estimated cost $150,000.

Conn., Bristol—H. Judd, 206 West St., will build a 1 story, 35 x 170 ft. blacksmith shop and garage on North Main St. Private plans.

Ga., Atlanta—Packard Motor Co., 414 Peachtree St., awarded contract for the construction of a 1 story, 79 x 224 ft. garage. Estimated cost $250,000.

Ill., Chicago—J. O. Stoll, 245 East Grand Ave., awarded contract for the construction of a 5 story, 150 x 150 ft. garage at 1011 North Clark St. Estimated cost $200,000. Noted Jan. 6.

Ind., Indianapolis—B. F. Mfg. Co., A. Foerderer, Pres., 2007 Ludlow St., is receiving bids for the construction of a 1 story, 60 x 110 ft. foundry at 2018 Massachusetts Ave. Estimated cost $40,000. Doeppers & Lennox, 226 East Michigan St., Archts.

Mass., Brookline (Boston P. O.)—M. W. Quinlan, 264 South Huntington Ave., Jamaica Plain, awarded contract for the construction of a 1 story repair and service garage on Boylston St. here. Estimated cost $40,000. Private plans.

Mass., Dorchester (Boston P. O.)—G. V. Wattendorf, 699 Columbia Rd., is receiving bids for the construction of a 1 story repair and service garage at Columbia Rd. and Everett Sq. Estimated cost $60,000. L. Kopczynski, 80 Federal St., Boston, Archt.

Mass., Everett (Boston P. O.)—Maltzman & Rovner, 22 Summer St., will build a 1 story, 85 x 140 ft. repair and service garage at Chelsea and Clinton Sts. Estimated cost $45,000. S. E. Moffie, 51 Cornhill, Boston, Archt. Noted Jan. 13.

Mass., Medford (Boston P. O.)—S. Weinstein, 1 Austin Park, Cambridge, is having sketches made for the construction of a 1 story, 90 x 200 ft. repair and service garage. Estimated cost $50,000. C. Springall, 50 Concord St., Malden, Archt.

Mass., New Bedford—Pelletier & Berube, 551 Belleville Rd., will build a 2 story, 80 x 200 ft. repair and service garage on Purchase St. Estimated cost $100,000. O. Saulnier, 12 Scott St., Archt.

Mass., Salem—Dow & Lewis, 102 Lafayette St., is having tentative sketches made for the construction of a 1 story repair and service garage on Bridge St. Estimated cost $50,000. Private plans.

Mass., South Boston (Boston P. O.)—Hunt-Spiller Mfg. Co., 383 Dorchester Ave., awarded contract for the construction of a 1 story foundry.

Mass., Worcester—Boston & Albany R.R., South Station, Boston, is receiving bids for the construction of a 2 story, 45 x 115 ft. addition to machine shop on Grafton St., here. G. A. Kirley, Ch. Engr.

Mo., St. Louis—Southwestern Bell Telephone Co., 11th and Pine Sts., will receive bids until Mar. 15 for the construction of a 2 story, 90 x 100 ft. garage at Chouteau and Tiffany Sts. I. R. Timlin, 1917 Southwestern Bell Telephone Bldg., Archt.

N. Y., New York—Consolidated Gas Co., 130 East 15th St., will soon receive bids for the construction of a repair and service garage on East 57th St. Estimated cost $200,000. Private plans.

N. Y., New York — Seventy Third & Third Ave Corp., P. Meyerwitz, Pres., 100 East 42nd St., is having plans prepared for the construction of a 6 story garage at 1260 3rd Ave. Estimated cost $200,000. V. Mayper, 15 East 40th St., Archt.

N. Y., Schenectady—General Electric Co., C. G. Hulth, Supt. Dept. of Buildings and Grounds, awarded contract for the construction of a 1 story, 180 x 280 ft. extension to building 109, the enameled wire works. Estimated cost $200,000.

N. Y., Syracuse—Nash Sales Corp., 713 West Genesee St., plans the construction of a 2 story, 130 x 267 ft. garage at 711 West Genesee St. Estimated cost $75,000. Melvin L. King, Dennison Bldg., Archt.

N. Y., Syracuse—The White Motor Co., R. C. Purcell, Mgr., 1107 West Genesee St., will receive bids about Apr. 1 for the construction of a 2 story, 3,000 sq.ft. sales and service station at 1124 West Genesee St. Estimated cost $200,000. Private plans. Noted Dec. 9.

N. Y., Troy—Hendrick-Hudson Garage Inc., Philadelphia, Pa. will soon award contract for the construction of a 4 story, 100 x 137 ft. garage here. G. S. Thompson, 257 Broadway, Troy, N. Y., Archt.

O., Cleveland—Cleveland Gasket & Mfg. Co., H. A. Lindsley, Mgr., 1610 West 116th St., awarded contract for the construction of a 2 story, 80 x 120 ft. factory at 1602 West 116th St. Estimated cost $75,000. Noted Jan. 13.

O., Cleveland—Crucible Steel Casting Co., W. H. Shepard, Pres., West 84th St. and Almira Ave., awarded contract for the construction of a 1 story, 102 x 160 ft. addition to foundry. Estimated cost $100,000. Noted Jan. 27.

O., Cleveland—The Ohio Bell Telephone Co., R. Eide, Gen. Mgr., 4300 Euclid Ave., will soon award contract for the construction of a 1 story, 65 x 200 ft. garage on West 110th St. Estimated cost $100,000. Christian, Schwarzenberg & Gaede, 1900 Euclid Bldg., Archts. and Engrs.

O., East Liverpool—Patterson Foundry & Machine Co., plans the construction of a 1 story foundry at St. George St., East End. Estimated cost $50,000.

O., Portsmouth—Taylor Universal Motor Co., is having plans prepared for the construction of a 2 story, 50 x 90 ft. repair and service garage at Scioteville and Gollia Sts. Estimated cost $30,000.

Pa., Coraopolis—Standard Steel Spring Co., plans the construction of a 1 story, 73 x 240 and 120 x 420 ft. factory buildings. Estimated cost $100,000. Private plans.

Pa., Philadelphia — Philadelphia Boiler Works, 1737 Fiebart St., plans the construction of a 3 story plant at 1708 Callowhill St. R. Benckert, 13th and Chestnut Sts.

Pa., Pittsburgh—H. Horbostel, Hardy Hayes Bldg., Archt., will receive bids until Feb. 19 for the construction of a 2 story, 80 x 128 ft. garage on Forbes St., for Schenley Apartment Hotel Co., Bigelow and 5th Sts. Estimated cost $150,000.

R. I., Providence—New England Auto Radiator Works, D. Troiano, is receiving new bids on revised plans for the construction of a 1 and 2 story additional unit to plant at 54-56 Federal St. Estimated cost $40,000. F. Chraverini, 32 Broadway, Archt. Former bids rejected. Noted Jan. 27.

Tex., Ft. Worth—Practical Tool & Steel Corp., awarded contract for the construction of a 1 story, 50 x 100 ft. factory for the manufacture and repair of oil field equipment. Estimated cost $20,000.

Tex., San Antonio—Goad Motor Co., T. J. Goad, Navarro and Augusta Sts., has acquired a site and plans the construction of a 2 story garage at Lexington and Dallas Sts. Estimated cost $45,000.

Tex., Weslaco—Weslaco Auto Co., will soon award contract for the construction of a 2 story garage. Estimated cost $50,000. R. H. Cameron, 116 City National Bank Bldg., San Antonio, Archt.

Ont., Brickville—E. F. Phillips, Electrical Works Ltd., 12 Mercer St., Toronto, plans the construction of additional buildings in connection with wire and cable factory including a 1 story, 12,000 sq.ft. building for enameled wire department. Estimated cost $150,000 to $200,000.